MODEL AIRPLANE NEWS

48120 January 1997

Easy-Build Electric Lightning

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JANUARY 1997 • VOLUME 125, NUMBER 1

MODEL AIRPLANE NEWS

Features

Construction

Departments

ON THIS PAGE: top—Craig Trachten gets the Midwest Products' Super Stearman ready for flight; middle—Cermark's F-20 Tiger Shark is a real performer on a .60 engine; bottom—Jim Ryan poses with his P-38 Lightning, an electric Speed 400 model.

ON THE COVER: this Jean Oldham painting originally appeared on the cover of the second issue of Model Airplane News in August 1929, 68 years ago.

Reviews

Columns

EDITORIAL

by TOM ATWOOD

TRENDS IN R/C

If you look at the technical developments in R/C modeling in recent years, it's a "no-brainer" that the 21st century will likely offer fantastic new prospects for our sport. New engines (and, for that matter, electric power systems), improved radio systems, a wider variety of model kits—and a lot more—will continue to emerge with each new flying season. But beyond new materials and technology (and new sources of information, such as the World Wide Web), are modeling interests *themselves* changing direction?

Most might agree that building kits, the occasional scratch project and flying at the home field will remain high on the list of preferred activities in the foreseeable future. But are trends discernible that suggest future directions of the sport?

Some months ago, a survey of nearly 300 of our readers yielded some interesting hints. It showed that our average reader is 51 years of age (about six years ago, he was 43) and has spent more than 20 years in the hobby. Go to a few clubs and you tend to see more gray heads than you did 20 or even 10 years ago. While this is certainly an alert that there's a real need for new blood in the hobby, it also suggests some degree of stability in overall modeling interests as we go forward.

Other results that profile our readers: the typical respondent owns six or seven model airplanes and spends about 11 hours a week on the hobby. Sixty percent own a PC. One in four is a full-scale pilot, and over half expressed an interest in full-scale aviation.

The survey also indicated 60 to 70 percent have a high interest in general sport flying and 44 percent in scale, "heavy-metal" warbirds. Nearly 60 percent of the respondents planned to build giant-scale models. Yet judging by the number of model engines of a given displacement range that are owned by a typical reader, interest remains strong in models of all sizes.

The loss of flying fields owing to objections based on noise has caused many to speculate about the future of electrics: 27 percent expressed an interest in electric-powered sailplanes and electric scale models. At the same time, 22 percent indicated an interest in ducted-fan models, and 25 percent showed a strong interest in aerobatics. This, coupled with the interest in scale, could signal greater IMAC and similar activities in future years.

Jim Ryan's sport-scale electric P-38 Lightning, featured in this month's construction article, is a great flier on two Speed-400 motors.

Trends in modeling interests may have a deeper significance; they may define what has succeeded most in keeping the interest of the intermediate-level modeler so that he stays in the sport. The better we understand modelers' interests, the better we can promote the hobby and strengthen our ranks by spreading the good news.

We're interested in your modeling interests and in the kinds of activities that are at your club's flying field. Send comments to my attention, care of *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606, or fax them to (203) 431-3000 or email me at: toma@airage.com. Let us know what's up and coming in your neck of the woods, and we'll report back on any input we receive!

DON'T MISS THESE!

Speaking of new technologies, products and trends, don't miss Chris Chianelli's expanded "Air Scoop" (page 11); it takes a sneak peek at new products for '97. In Europe in recent years, the popularity of Speed-400 powered electrics has been growing, and that trend is now spreading through the U.S. One reason is that Speed-400 motors are inexpensive and simple to install. In Jim Ryan's construction article (page 54), we show you how to build a beautiful, flyable, sport-scale P-38. Want to fly it in a scale-like fashion at your next club contest? Then take a look at Dave Patrick's feature (page 22) and learn the techniques of a master.

NEW EDITOR ON BOARD

We are pleased to announce that Larry Marshall has joined the *Model Airplane News* editorial team. Larry, who has a Ph.D in Evolutionary Processes and who worked as a scientist in entomology and forestry before joining Air Age, brings a broad modeling background to the magazine. He flies FF, CL and R/C and belongs to a variety of modeling organizations including the IMAA, Flying Aces and the Society of Antique Modelers. In recent years, Larry has been active in various online discussion groups, particularly with respect to electrics. He candidly and cheerfully describes his preferred hobby interest as "anything with wings." His technical savvy and genuine excitement for our fine sport will only strengthen our primary goal—to bring you, each month, the finest modeling magazine in print.

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AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News**, 100 East Ridge, Ridgefield, CT 06877-4606; e-mail: man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous number of letters we receive, we can not respond to every one.

PROPPED FOR SPEED

I was very interested to read the letter in the October '96 issue from Brian Reed of Franklin, PA, regarding the model with which he plans to attempt to break the 200mph barrier. I suppose many people know the physics of power/ prop/speed ratios. I did a small calculation based on the fact that no propeller-driven aircraft can exceed the theoretical forward screw travel of the propeller in level flight. A 10x10 prop can only travel in theoretical space as fast as the prop can turn with only 10 inches of forward travel per revolution and not one bit faster. Since 220mph is 322 feet per second, the 10-inch prop would have to be turning at 23,231rpm to make that speed—with absolutely no drag. A more realistic prop would be a 11x14, which would have to make only 16,560rpm to meet the goal of 220mph. To turn that prop at that speed, the horsepower required would be somewhere around 5 to 6.5. Naturally, to get the airframe to the required speed will require even more power and rpm on the prop. As the drag, air temperature, humidity and air-density factors come into play, the equations get really complex.

My point is, to exceed the 220mph limit by any appreciable amount, we will either have to come up with radically new engines that can meet the small-prop rpm requirements or switch to the ducted-fan, or even gas-turbine, aircraft engines. Speed isn't the limit; horsepower is.

I think the best prop size for the model aircraft that will eventually go well beyond the 220mph barrier will be 24 inches or more, simply because the pitches at that diameter allow lower, more attainable rpm and horsepower requirements. This speculation seems warranted by the October '95 "Final Approach," which mentions the giant-scale, unlimited racers topping 200mph [and in which Russ Pribanic flew a prop-driven delta configuration more than 200mph].

Another limiting factor for R/C models operating in these very high speed ranges is the pilot. At 220mph, a model will cover the typical 400-foot model runway in just 1.24 seconds and be over a quarter mile away in little more than 4 seconds. That's something to think about.

JAMES BASS
Roswell, NM

Excellent analysis and insight, James. We hope that your comments will stimulate even more interest in going fast! DS

LUBRICANT LIMBO

I'm getting totally frustrated with the conflicting information I get from hobby shops, mail-order houses and experienced modelers at the field on the subject of proper lubrication for our glow engines. Some recommend castor while others insist on synthetic. I can get any percentage figure for proper volume you can imagine, depending on whom I ask. At times, I think a hobby shop owner is just swearing by a certain brand because that's what he has in stock. Am I getting paranoid? Maybe he has that brand in stock because he really has found that it better protects our expensive engines. Any light you can shed would certainly be appreciated.

I'm just a Sunday flier who's trying to treat his engines right. Thanks.

JACK MEYERS
Fort Worth, TX

Jack, the subject of fuel has, to say the least, been the cause of much heated debate, to put it somewhat euphemistically. The harsh reality is that I've heard guys hurl "colorful metaphors" at one another when this subject is broached. While at a trade show, I watched what started out as controlled debate end up on a rather silly, fist-waving, adversarial note. It's true there are special fuel requirements in some of the more specialized segments of our hobby, e.g., special nitromethane considerations in racing and lubrication requirements in some large displacement giant-scale, 2-stroke glow engines. But for us average sport modelers (myself very much included) who run mostly .40 to 1.20 2-stroke and 4-stroke engines, the answer to this debate, in my humble opinion, is really so simple. Read the instructions! If the manufacturer recommends a certain volume of lubricant for an engine, stick to it religiously. For example, O.S. and Thunder Tiger recommend no less than 18 percent lubricant fuel and Enya specifies 20 percent for break-in and 15 percent for running. The factory guys know what the heck they're talking about. They designed the damn things! Now I know there are some self-anointed "experts" who will tell you, "Engine manufacturers know about designing engines, but they know little about fuel!" Forgetting for the moment that such a statement is, to say the least, dubious, I ask you to consider this: the manufacturers, not the "would-be" expert, will back your warranty. They have the option to honor or void your warranty as they see fit. So ... whom do you think you should listen to? Don't second-guess factory recommendations.

Furthermore, I would only use a fuel whose lubrication volume by percentage is printed on the label or can be obtained by calling the manufacturer. If manufacturers want to keep their particular synthetic oil formula a secret, OK, fair enough. But to keep the percentage a secret? I can't imagine any reason why they would do this. By stating on the label what the volume is, the fuel manufacturer lets the user feel some level of comfort in the knowledge that factory requirements are being met (or not). By doing so, manufacturers are not asking you to throw caution to the wind. They are not asking you to blindly trust that a "mystery blend" isn't going to ruin your engine or void your warranty. With extended engine warranties popping up (like Saito's 3-year limited and Enya's 5-year limited), it's very understandable that engine manufacturers expect you to assume the responsibility for maintaining proper lubrication percentages. Take on the responsibility!

On the subject of castor versus synthetic, all the true experts I confer with, who are highly respected throughout the industry, are in agreement. A blend of synthetic and castor oil has proven to give excellent all-around protection. Twenty-five years ago, I used fuel with all castor, which seemed to work well with the ringed aluminum and lapped meehanite (basically, high-grade iron) pistons of that time. With modern ABC technology, trends seem to have changed. Others contend that today's castor isn't as pure as it once was and therefore varnishes more easily. I have no data to support or refute this. As long as you have at least 5 percent or more castor in the total oil blend, you'll get the lean-run and corrosion protection castor has to offer.

Again, you'd be wise to follow the manufacturer's recommendations and turn a deaf ear to conflicting pontificators. CC

New for '97

Been wondering what hot new R/C plane products are going to hit the hobby store shelves in 1997? My Model Airplane News spies and I have been scouring the countryside in search of the latest "gotta-have" gadgets, gizmos and great fliers. Here are the goods; remember, you saw it here first!

SPECIAL AIR SCOOP

by CHRIS CHIANELLI & HIS LOYAL STAFF

Scale Slopers

Have you done any combat slope flying? Here's a new way of doing it—with style. Dave's Aircraft Works has just released a "Foam51D" and a "foaME109." Rumor has it that a KI-61 will follow shortly. These scale slopers are built entirely of EPP—a rubber-like foam material. Not only do these gorgeous planes fly like full-size airplanes, but they also bounce when you crash them.

For more information, contact Dave's Aircraft Works, 123 Avenida Buena Ventura, San Clemente, CA 92672; (714) 498-4478; email: 104271@compuserve.com.

IMAA Aeromaster

When I first started to fly R/C in 1970, the Aeromaster was *the* biplane to have—an icon of the accomplished R/C flier and modeler in the more "élite" circles of the local club. Ah, yes, the old days! When you showed up at the field with your recently completed Aeromaster powered by one of those "large" .60 2-stroke engines, you had arrived! End of story. Anyway, the original had an approximate wingspan of 50 inches, depending on whether you built the straight-wing or swept-wing version, and it really flew well. I can only assume that the Giant Aeromaster with its wingspan of 73 inches will fly superbly! It features interlocking, all-wood, die-cut parts; a unique, dual, bolt-on wing for fast assembly at the field; a three-piece ABS cowl that fits cleanly around a 41cc gas engine; and two-piece ABS wheel pants designed for 4-inch wheels and heavy-duty Duraluminum landing gear. Specifications: wingspan—73.6 inches; wing area—1,777.2 square inches; weight—16.5 to 18.5 pounds; engine—30 to 60cc ignition or 1.40 to 2.76ci glow power; radio—4-channel with six servos. I'm sure all of you would like to see a full report on this legendary R/C biplane; we're working on it!

With Lightning Speed

This isn't the first time Altech Marketing's gregarious product development manager Akiko Kimura has graced the pages of my "Scoop"! Can you blame me? Well, anyway, this time, she's holding the new F-22 Stealth Lightning II aerobatic sport model. Designer Jeff Troy certainly has a knack for making trainers, intermediate trainers and sport planes look anything but boring. A longtime modeler, Jeff really understands Sunday fun-fliers and how to spark their excitement. Jeff also designed Altech's very successful F-14 Tamecat. Like the Tamecat, the F-22 is an almost-ready-to-cover (ARC) model. Simply join the wing panels, cover the components, and the airplane is ready for final assembly. Finishing methods are described in the manual, but the plane's appearance is totally at the modeler's discretion. The design calls for a .40 to .60 2-stroke, or a .53 to .80 4-stroke. The 53.5-inch, double-taper, sheeted wing has built-in washout for low-speed stability. The F-22 can be covered and ready to fly in lightning speed (two or three evenings).

For more information, contact Altech Marketing, P.O. Box 7182, Edison, NJ 08818-7182; (908) 225-6144; fax (908) 225-0091.

New for '97

Staudacher 300GS

"Crisp," "precise" and "axial" are the words that expert pilots are using to describe the new Staudacher 300GS from Aero Craft. This 30-percent-scale model was designed for unlimited IMAC aerobatics and is sure to be the hot ticket for the '97 flying season. The model has a 90-inch span and a wing area of 1,450 inches, and it was designed for 3.2 to 4.6ci engines. The 300GS features foam-core, plug-in wing panels; a built-up fuselage and tail group; aluminum landing gear; a fiberglass cowl and wheel pants; and a formed canopy. The introductory kit costs $399 (plus S&H), and the introductory built-up ARC version costs $995 (plus S&H).

For more information, contact Aero Craft, 5743 Norton Rd., Vernon Center, NY 13477; (315) 829-4168.

Speedy Bee

Andy Clancy of Lazy Bee fame is appealing to those who want a somewhat different Bee in their hangars. This new midwing version has the same slow speed and high power-to-weight ratio as its predecessors but in a "Speedy" planform. There's also the new Lazy Bee Special, which is a version of the original Lazy Bee design, but with ailerons.

For details, contact Clancy Aviation, P.O. Box 4125, Mesa, AZ 85211-4125; (602) 649-1534, fax (602) 649-9040.

G/F Series 11 new sizes!

In preparation for the upcoming '97 flying season, Windsor Propellor has released props in 11 new sizes in their Master Airscrew G/F Series: 7x5, 8x5, 8x7, 9x7, 10x4, 10x5, 10x9, 11x4, 11x5, 11x8 and 11x10. Designed and produced with Windsor's state-of-the-art CNC technology, the props feature NASA airfoils, true helical pitch, durable glass-filled nylon material and they're lightweight and accurately balanced. The sizes remain true to the original G/F Series in appearance; however, thrust performance is improved at lower rpm. Though these props are available now, the existing Master Airscrew line will be updated with the new tooling and technology.

For a free catalogue, send an SASE to Windsor Propellor Co., 3219 Monier Cir., Rancho Cordova, CA 95742; email: 72673.110@compuserv.com.

Air Superiority

In the past year, the introduction of Global's kits and ARF offerings has been fast and furious. Their product line is rapidly becoming prodigious. I've seen nothing to compare it with since the military buildup during the Reagan years! Joining the Global "air force" are the Raven and the Avenger 45—two ARFs that are made of balsa, plywood and hardwood and covered with Ultracote. The 52-inch-wingspan Raven, which is manufactured under exclusive license from full-scale pilot/owner Wayne Handley, comes with a Raven spinner, a custom fiberglass cowl (which is factory-painted to match the Ultracote), custom wheel pants and canopy and easy-to-apply Raven decals. Like the Raven, the 59-inch-wingspan Avenger 45 comes with a spinner, a fuel tank and a hardware package; plus, you have the option of installing fixed landing gear or fitting retracts, which are also available from Global. The wheel wells and servo well are already built into the wing. Just cut away the covering to expose them, or leave them covered if you want fixed gear. For power, the Raven requires a .40 to .53 2-stroke; the Avenger requires a .40 to .53 2-stroke or a .48 to .80 4-stroke.

For more information, contact Global Hobbies, 18480 Bandilier Cir., Fountain Valley, CA 92728-8610; (714) 964-0827; fax (714) 962-6452.

New for '97

More than a Trainer

Thunder Tiger and Horizon have joined forces to create the .40-size Trainer 2000 ARF. The all-wood model has a 61.5-inch wingspan (with an area of 675 square inches), and it's factory-covered in vibrant colors for high visibility. The T-2000 is reported to have smooth and forgiving flight characteristics with positive self-recovery—excellent attributes for the fledgling pilot. What makes the T-2000 different from other trainers? It comes as a total training package. Included for the $149.95 selling price is a professionally produced video called "Ticket to Fly." This 32-minute tape guides you through every step of the learning process and includes tips on assembly, breaking in and tuning your engine and proper radio setup; finally, at the field, you're shown how to control your plane and what to expect as your skills progress. There's even a segment on finding and working with an experienced flight instructor. From the sound of it, this may be the most complete trainer package to date. We'll take a much closer look at this model in a future article.

The Trainer 2000 is distributed exclusively by Horizon Hobby Distributors Inc., 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511; website: www.horizonhobby.com.

Giant Revolution

Revolution is a new name in spinners that you might want to remember. Totally machined out of bar-stock aluminum, this high-end line is available in nine sizes and three shapes: Standard, Ultimate and Extra. The Ultimate and Extra have true scale out-

lines that make them perfect for those particular giant-scale projects. According to Ohio R/C (the exclusive distributor), these spinners boast maximum strength and balancing—all at affordable prices. Adapter kits for eight popular engines are also available.

For more information, contact Ohio R/C, 4251 Lutheran Church Rd., Germantown, OH 45327; (513) 859-1660; fax (513) 859-7202.

83cc Twin

Are you looking for more punch for your Pitts, more energy for your Extra, more thunder for your Tempest? If you like the smooth-running characteristics of twin-cylinder engines and you have the need for more power, the new D&B Engines 83cc twin could be just the powerplant you're looking for. D&B is known for its line of electronic ignitions and its popular 3.7ci twin-cylinder engine, and its 83cc (5.1ci) twin should be available by the time you read this.

What about numbers? Check these out: total weight (including mufflers and ignition system)—6 pounds, 6 ounces; width—$10^{5}/_{16}$ inches; turns 8,200rpm turning a Bolly 22x10 propeller.

The engine has ball bearing and needle bearings throughout, and the electronic ignition is built in. At $1,200, this twin should find its way into many giant-scale unlimited aerobats and warbirds.

For more information, contact Ridge Machine Co., 2700 Austintown-Warren Rd., Warren, OH 44481.

Extra at the Magic-6

Generally, I've found that models really start to exhibit full-scale flight characteristics—flying "on the wing" as the expression goes—when the span hits around the 6-foot mark. With its 72-inch wing, which fits into most cars, the Ohio R/C Extra 300L is a very attractive buy. The kit's machine-cut, high-quality balsa and plywood parts, fiberglass cowl and wheel pants, and rolled, full-size plans make the 300L yet another first-class offering from this respected manufacturer. The kit also includes a crystal-clear canopy, a complete hardware package and a high-quality, formed landing gear. Specifications: wingspan—72 inches; wing area—910 square inches; flying weight—9 to 11 pounds; length—64 inches; engine requirements—1.08 to 1.20 2-stroke, or 1.20 to 1.60 4-stroke.

For more information, contact Ohio R/C, 4251 Lutheran Church Rd., Germantown, OH 45327; (513) 859-1660; fax (513) 859-7202.

The Donald—by air, land or sea

Long-time modeler and Hobby Lobby owner Jim Martin has this to say about the Donald, "This electric seaplane may be the best flying R/C airplane we've seen yet; don't believe me? Get the video!" (The video costs $9 and is returnable for a $6 refund.) I'm a float-flier from way back, and I've viewed this video. This little plane really does have great flight performance, and with its flip-up rudder and wing sponsons, which are rubber-banded to the wings, water-taxiing characteristics are quite good. I watched the model do many full-stop takeoffs and landings (more than a dozen), and the battery didn't have to be recharged. Flight duration was quite impressive. The low-drag, complex hull shape and the step design with sharp chines help the Donald take off from water with an inexpensive Speed 600 motor and a 7-cell battery pack. The Donald can also be flown as a land plane, and the plans show a landing-gear installation. This complete, high-quality kit takes very little time to assemble. It features a beautiful, white, fiberglass fuselage/hull with balsa rib/spar wings and stab that have already been built and are ready for covering. Specifications: wingspan—55 inches; wing area—428 square inches; flying weight—49 to 53 ounces; wing loading—17 to 18 ounces per square foot. Price—$199.

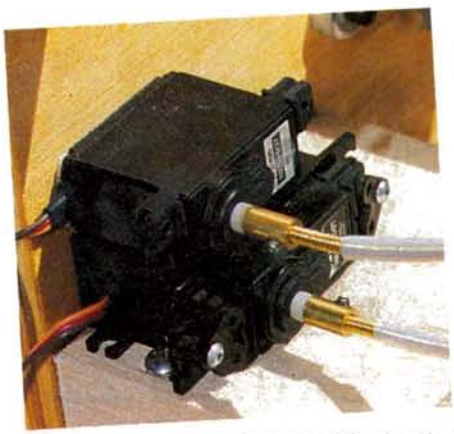
For more information, contact Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948.

Flirting with Disaster?

Some crashes are funny; others are anything but. If your long-term, pride-and-joy scale projects are now, at last, airworthy, that truly heartbreaking crash could be just around the corner, and you'd never know. Battery failure is so easy to avoid and, with the introduction of Ace R/C's SmarTest, inexpensively avoidable! Even the "Cheapest man in town" award winner wouldn't balk at the price of this new unit.

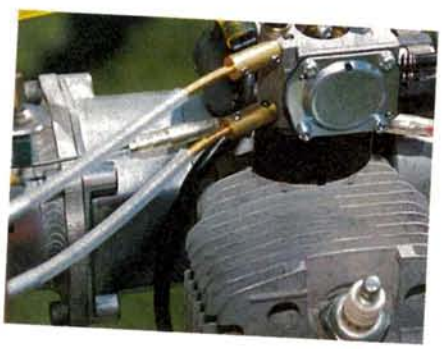
Ace has kept the price down by letting you charge your packs with your system's existing charger and by letting the batteries being discharged act as the power source, thereby eliminating the need for an AC power supply. (By the way, after discharge, the system "goes to sleep" so the batteries are not run-down, stone-cold dead.) This circuitry "trimming" of the SmarTest design has cut costs by 50 percent. The most important stuff is retained—things like an onboard computer with accuracy of 0.1mAh below and 1.0mAh above 1,000mAh. Simply put, the SmarTest gives you lab accuracy at a budget price. I know how some of you guys are. You spend the winter building the most gorgeous scale project and then put a 1971 Orbit radio in it, exclaiming, "She's got one more season of service in her, I just know it!" The fact is, you don't know it. Even with a new system, none of us knows much at all about the capability of our batteries if we don't cycle them. Oh, yes—the price: a suggested list price of only $64.95. Lloyds of London couldn't supply better insurance at any price! You know, every once in a while, a product comes along that I really think every one of us should have. Ace's SmarTest is just such a product.

For more information, contact Ace R/C, 116 W. 19 St., Higginsville, MO 64037-0472; (800) 322-7121.



Snake Drive

Here's a new twist on throttle-linkage setups for gasoline engines. The Snake Drive, designed by Unique Design and Development's Ralph Delorio, eliminates all the bellcranks, pushrods and ball links used to connect the throttle servo to the carburetor. Simply attach the Snake Drive directly to the output spline of your servo and to the carb butterfly-shaft. The flex cable is supported by a flexible housing that's much like a model boat flex-drive setup and transmits servo rotation to the throttle butterfly-shaft with virtually no slop. Included is an 18-inch-long flex cable, two couplers with setscrews, thread-lock for the setscrews, a flexible outer housing and a length of rigid tubing for support. The Snake Drive is available for most Zenoah and Quadra engines. Price—$24.95.



For more information, contact Unique Design & Development Co.; (distributed by) Webster's Hobby Shop, 1116 N 183, Seattle, WA 98133; (206) 546-5159.

New for '97

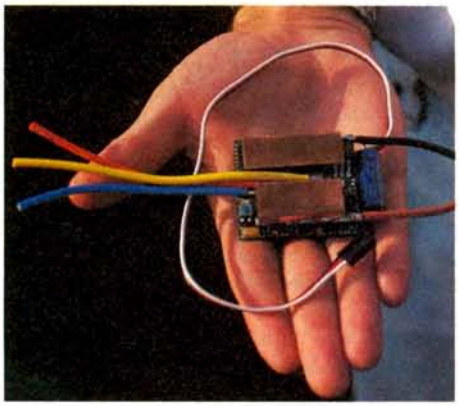
Agwagons for one and all

We received a letter from Randy Hansen expressing his appreciation for mentioning the Venerable Cessna Agwagon in the October '96 "Scoop." He says that the modeling world has disregarded Ag planes for far too long.

Randy now imports a fine line of model Ag plane documentation, plans and accessories produced by Warren Russell, owner of the New Zealand Aero Products.

Warren has a beautiful kit of a Cessna A-188 Agwagon that Randy has built. Powered by a G-62, this 38-pound, 128-inch-span plane goes together easily, and it's fun to fly. More kits are soon to follow and will include the Grumman/Schwiezer AgCat and the Airtractor 502.

For more information on these great flying "birds," contact Randy Hansen, Northwest Ag Aircraft, Rt. 4, Box 575-28, Astoria, OR 97103; phone/fax (503) 458-6686.



New Aveox Controller

Aveox Electric Flight Systems has announced the release of its long-awaited microprocessor-based speed control. The microprocessor provides a number of features, including adjustable brake rates, BEC and over-temperature control. This is the first controller to feature Aveox's HybriDrive™ control electronics, and it's more efficient than other brushless controllers. It's available in 6- to 20- and 14- to 32-cell versions.

For more information, contact Aveox Inc., 31324 Via Colinas #103, Westlake Village, CA 91362; (818) 597-8915; fax (818) 597-0617.

This Mini is Mighty

This new HS-225BB servo from Hitec has it all: high speed, high torque and small size. This impressive little servo weighs only .98 ounce, it has 70-inch ounces of torque, and it's fast! How does a 0.10-second transit speed at 6 volts sound? At 4.8 volts, the torque is 55 in.-oz. and the transit time 0.14 seconds. The best part is the suggested list price of only $49.95.

For more information, contact Hitec/RCD, 10729 Wheatlands Ave., Ste. C, Santee, CA 92071; (619) 258-4940; fax (619) 449-1002.

Lanier Extra 3.25

Lanier RC offers high-quality balsa kits at very attractive prices and is now kitting Rich Uravitch's very popular Extra 3.25 (which was originally available as plans only from *Model Airplane News*). The all-wood kit retains the original plans' dimensions, but it also offers interlocking fuselage construction, a totally built-up wing, ABS cowl and wheel pants and aluminum landing gear. Specifications: wingspan—47 inches; length—36.5 inches; power—.19 to .32 2-stroke.

For more information, contact Lanier RC, P.O. Box 458, Oakwood, GA 30566; (770) 532-6401; fax (770) 532-2163.

New for '97

35% Giles G-202

Joining the ranks of Cactus Aviation's top-drawer, giant-scale aircraft is this 92.5-inch Giles G-202, which was designed by Wendell Hostetler (who also offers the plans for this beauty to scratch-builders). Like other Cactus offerings, the G-202 is handcrafted in Germany and has a meticulously gelcoated, epoxy/glass fuselage with firewall and bulkheads installed. Other features include a balsa-sheeted foam wing, stabilizer, rudder and elevator; installed leading and trailing edges; an aluminum-tube, plug-in spar; and cut and capped ailerons. Wing area—1,635 square inches; weight—22 to 24 pounds; power—3.7 to 4.2ci.

For more information, contact Cactus Aviation Models, 10380 E. Heritage Pl., Tucson, AZ 85730; phone/fax (520) 721-0087.

Piezometric Command

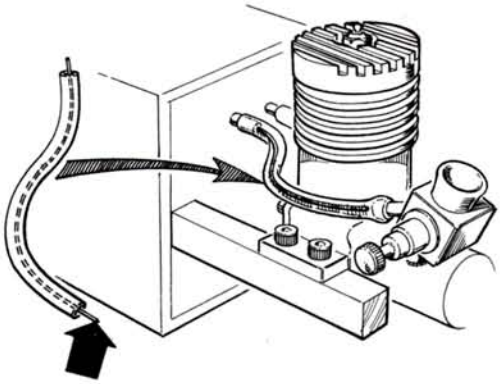
About three years ago, JR released its first piezoelectric gyro, the NEJ-1000. With its unlimited service life, aggressive response and adjustable gain from the transmitter, it made quite an impact in helicopter circles. The new NEJ-3000 is the most aggressive gyro yet. According to Horizon, helis flown with the 3000 fly rock-solid like never before. They resist weathervaning almost completely, and 3D maneuvers like pirouettes are performed with a crisp snap. When you want your heli to stop turning, it does—like right now! This fast response is made possible by the gyro's higher operating frequency, and when it's used with the required JR 2700G Super Servo, which has a transit time of .09-second/60 degrees, the 3000's response is equally matched with brute holding power. The 3000 also features an over-travel limiter that allows the user to set the limits of left and right throw independently without affecting the response curve.

For more information, contact Horizon Hobby Distributors Inc., 4105 Fieldstone Rd., Champaign, IL, 61821; (217) 355-9511; website: www.horizonhobby.com.

Hints & KINKS

by JIM NEWMAN

Model Airplane News will give a free one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o Model Airplane News, 100 East Ridge, Ridgefield, CT 06877-4606. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



PREFORMED FUEL LINE

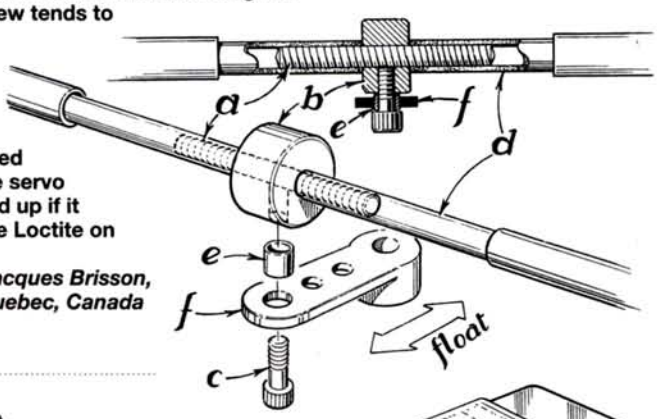
To prevent plastic fuel line from touching a hot cylinder, put very thin steel wire (not brass or copper) inside the tube, and then curve it to prevent it from touching the engine.

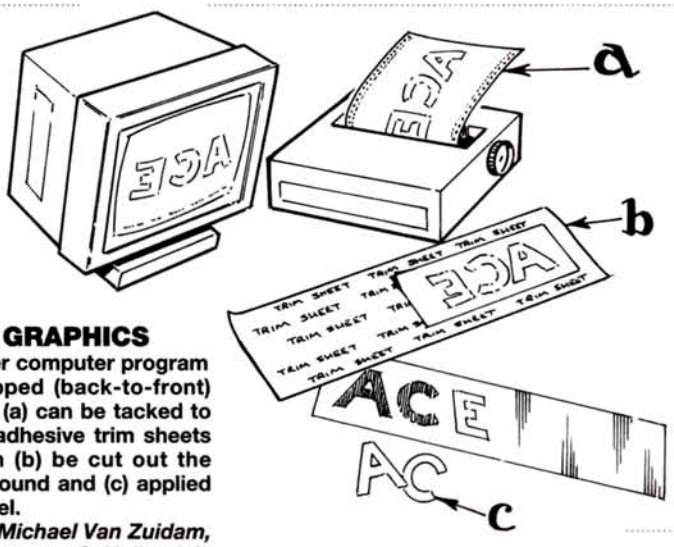
Peter Russell, Worksop, Notts., England

NYROD CONNECTOR

Ideal for ganging several throttle bellcranks to one servo in a multi-engine layout. A threaded stud (a) is clamped into the wheel collar (b) by a setscrew (c). The Nyrod halves (d) are screwed to the stud. Your columnist recommends that you use a short, brass-tube bushing (e) that's slightly longer than the thickness of the servo arm or crank (f) and that you arrange for the servo or bellcrank mount to float back and forth slightly, because as the servo arm moves through its arc, the setscrew tends to change its position fore and aft (and, unlike pushrods, the Nyrods are glued in place, so the servo will tend to load up if it can't shift). Use Loctite on the setscrew.

Jacques Brisson, Arntfield, Quebec, Canada

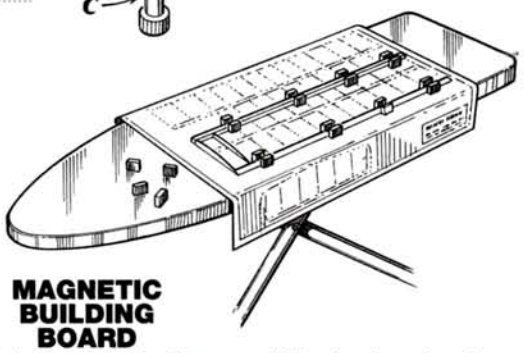




EASY GRAPHICS

Use a banner computer program to print flopped (back-to-front) images that (a) can be tacked to the rear of adhesive trim sheets so they can (b) be cut out the right way around and (c) applied to your model.

Michael Van Zuidam, S. Holland, IL



MAGNETIC BUILDING BOARD

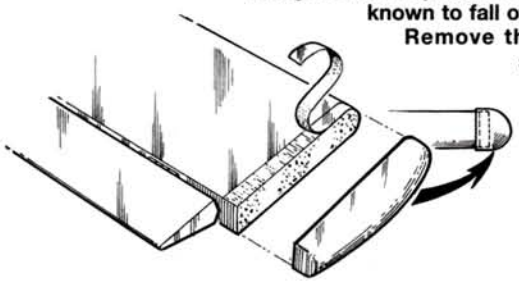
Strip the covering from an old ironing board, collect a pile of magnets (Radio Shack is a good source), then use the board to build on, with the magnets holding parts in place. A yard sale might yield an inexpensive board.

George Crowell, Evergreen, AL

SECURE ARF CAPS

The plastic wingtips and tail tips on most ARFs are glued to the plastic covering and have been known to fall off or jam the controls. Remove the tips, trim away a strip of the film, and then glue the tips to the exposed balsa, making certain that the tips overlap the film to keep oil off the balsa.

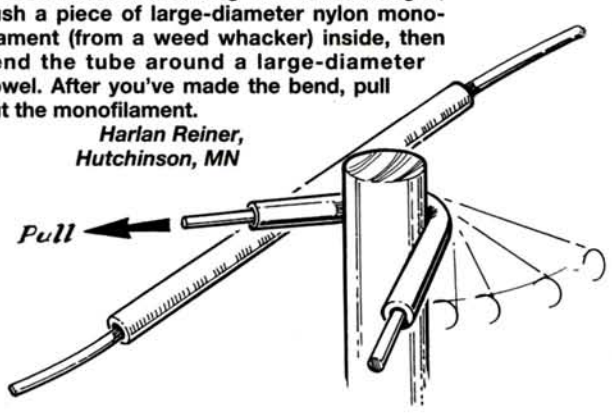
Joseph Ricco, W. Palm Beach, FL



MINI PIPE BENDER

To bend soft fuel tubing without kinking it, push a piece of large-diameter nylon monofilament (from a weed whacker) inside, then bend the tube around a large-diameter dowel. After you've made the bend, pull out the monofilament.

Harlan Reiner, Hutchinson, MN



MODEL AIRPLANE NEWS
HOW TO

Fly Scale Maneuvers

A master shares his secrets

by DAVE PATRICK

MOST OF my experience with aerobatics has been in pattern, TOC and IMAC, so when world-class scale modeler Graeme Mears asked me to fly his model at Top Gun, I was flattered, to say the least! To be involved in this premier scale event with the best models in the world is something I had to try. Graeme's models were winning static contests everywhere, and his new 110-inch Tiger Moth was no exception. Even before it was test-flown, he had received an offer to buy it that was so high it had everyone buzzing. Yikes! Now I had to think of that added responsibility.

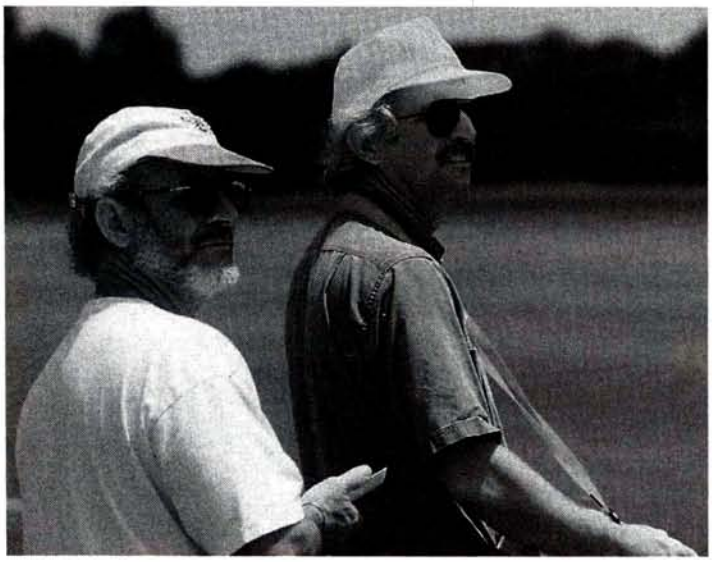
After I had accepted Graeme's offer, I began to consider which approach would be the best for this event because I had never really participated in a scale contest before. In competition aerobatics, we're concerned only about the execution of the maneuver, period. For example, loops need to be perfectly round and centered, and precision is the key to achieving the highest score. But in scale, we are to execute the loop as the full-size aircraft would have performed it. For example, the real Tiger Moth loops were egg-shaped, and by gosh, that's the way we have to do it! That's one of the reasons the R/C jet pilots do so well in scale: they can perform a loop without really having to "add" realism, because a real fighter jet could perform a perfectly round loop. A really interesting twist in scale competition is that the pilot must brief the judges to describe how he will fly his model in a realistic fashion and how the full-size version flew. So I needed to find out as much about the full-size aircraft as possible. As it turns out, the Tiger Moth is a real favorite of mine because I think this classic '30s biplane is a unique beauty. My father received his basic flight training during WW II in one, and he gave me insight into what it was like to fly. In addition, Graeme had a Tiger Moth flight manual that turned out to be very handy because it described how to fly specific maneuvers.

We learned that the Tiger Moth was a very lightly loaded biplane trainer with very modest power. In fact, it had a cruise speed of only 75mph. Because the plane had lots of rigging, fixed gear, etc., it also had a lot of drag and would not do a loop like an Extra 300S! I think of the Tiger Moth as a Piper Cub with two wings and a lot more drag.

According to the flight manual, to perform a simple loop, this bipe had to reach 135mph at full power, which was almost double its cruise speed of 75mph! According to my father, this meant that a very long, steep dive was needed. If the Tiger Moth didn't reach 135mph, it simply would not make it over the top of the loop. Research pays!

So with this information, we test-flew this beautiful model, and as a testament to Graeme's workmanship and judgment of engine size, prop, etc., it flew very realistically: slowly. Because of this, it was almost mandatory that we fly this model in a prototypical fashion. Every time I flew it, I just couldn't resist thinking that this *was* just like the real Tiger Moth, and I remembered my father's stories, told so many years ago, about how he flew this little plane that endeared aviation to him forever.

With this background, I'll explain my approach to "scale-flying" the Tiger Moth to first place this year at Top Gun. Different planes require different flying styles, but my approach to scale flying can be adjusted to suit your model. The flying at Top Gun represents half the total score, and static score accounts for the other half. Because both carry equal weight, flying well is very important. We get four flights, and the average of the best three scores is the final flight score. In each flight, 10 maneuvers are flown. Five are mandatory. The highest possible score for each maneuver is 10, so the pilot can earn a total flight score of up to 100 points.



Graeme Mears, builder (left), and Dave Patrick, pilot, concentrate hard during the last Top Gun '96 flight, which gave them the victory.

MANEUVERS

Mandatory maneuvers are takeoff, high-speed pass, low-speed pass, landing approach and landing. Aircraft that have certain working features can perform optional maneuvers such as using landing gear and flaps. The benefit of those options is if they work, you'll probably score a 10, so there is a strong incentive to enter a complex model. Unfortunately for us, we had to fly all the options, which were a loop, a barrel roll, a stall turn, a 2-turn spin and a snap roll.

We chose more difficult maneuvers primarily because we thought we had a unique model, and it seemed no one else was attempting the challenging options. Plus, we thought it would simply be more fun, and hey, isn't that what flying is all about?

When you perform any maneuver, it's important to know a lesson I learned many years ago when I took flying lessons in a Cessna 150. My instructor said, "Remember, airspeed is attitude, and power is altitude." I thought about it, and frankly, it didn't sink in until he showed me that even at full power, he could pull up the nose about 45 degrees, and the aircraft would stall ... hmmm. Then, throttling back, he pointed the nose down, and even at idle, we were going fast. The lesson here is to be very careful, especially with a

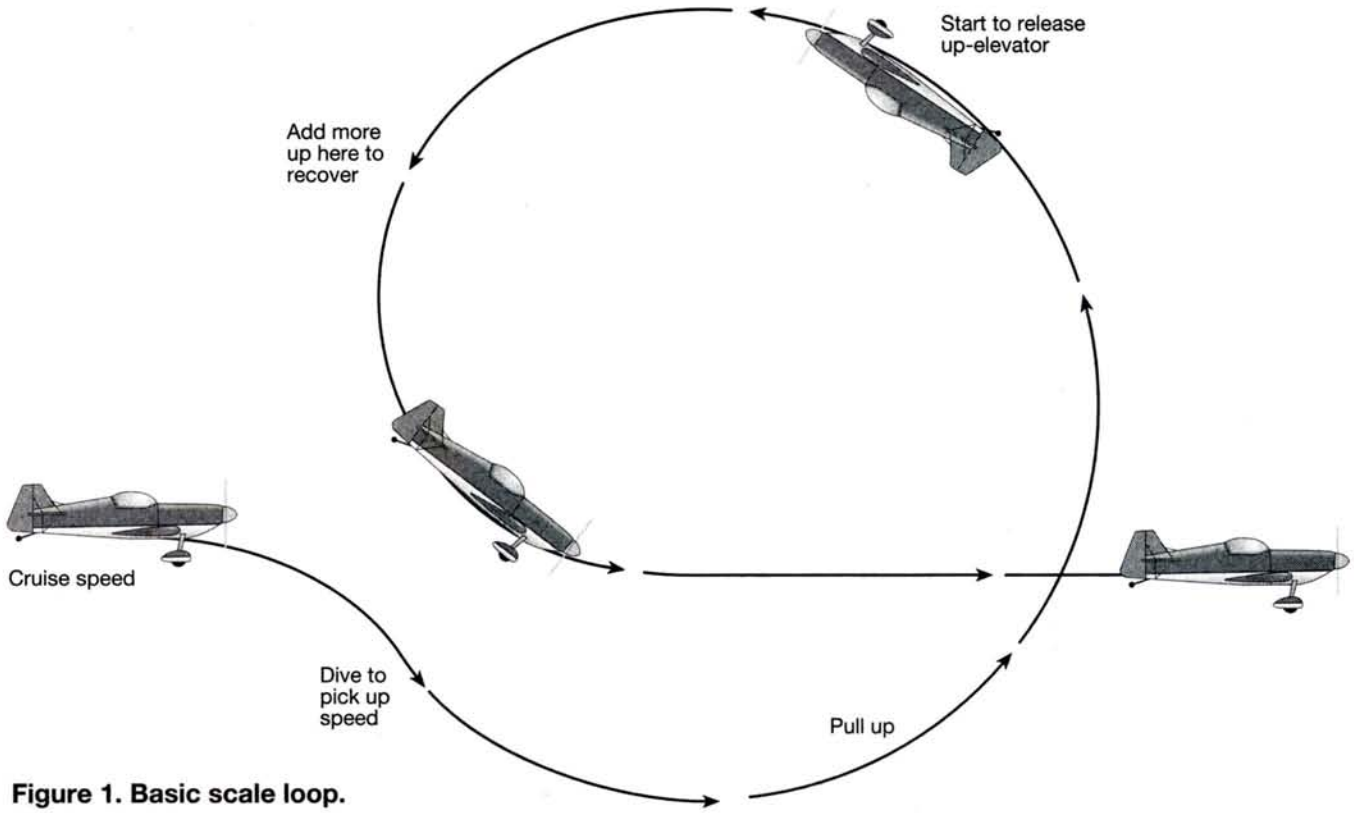


Figure 1. Basic scale loop.

scale aircraft, because even at full power, it is so easy to pull too much up-elevator and stall, especially shortly after takeoff. This is a pretty classic crash scenario, and you should keep it in mind as you fly. If you forget this little rule close to the ground, you'll need the epoxy!

Let's go through each maneuver briefly to explain how we approach scale flying.

TAKEOFF

When you fly a lightly loaded tail-dragger without a heck of a lot of power, extra care is needed. So after lining up on the runway, first, if necessary, apply aileron into wind. At Top Gun, I found that this was very important because there was a strong crosswind that claimed several planes that day! The wind was from the left, so I had to apply left aileron. How much? I used about 50 to 100 percent, but when you fly, conditions will dictate the amount you apply. Now here's the tough part: at the beginning of the takeoff roll, you will need right rudder to compensate for torque. But what if you have a wind from your left, as we did at Top Gun? The plane will have an even stronger tendency to weathervane to the left. With the left aileron, even more right rudder and up-elevator are required to prevent the plane from nosing over slowly. Add power and observe carefully what the plane does. As speed increases, relax up-elevator, and the tail will lift; wait until you've reached a safe speed before applying a little up-elevator to lift off. While doing this, use the rudder as needed to keep the aircraft on the centerline, and maintain left aileron until liftoff. You want to ensure that the crosswind does not get under the left wing and flip the plane over, so lift off by carefully forcing the right wheel to leave the ground first.

Whew! It's a lot to think about, but you know, this is the way a full-size aircraft takes off in a crosswind. And if you think about it before you fly, you won't be surprised; it's not that hard. Oh, yes; I almost forgot: I can't tell you how many models I have seen destroyed because of a premature rotation and/or a climb-out that was too steep. Please make sure that you have plenty of speed at rotation, and climb out at a shallow angle to maintain a safe airspeed.

GENERAL FLYING

Be very gentle on the controls; remember, you are supposed to have passengers! It wouldn't hurt to go to an airport and watch some full-size planes because you'll quickly see that they appear to fly slowly and very smoothly. I fly mostly aerobatic planes, and this is great training and hones your skills, even if you have no intention of ever

Top Gun is held at the beautiful polo grounds in West Palm Beach, FL. Here, we taxi out for the final flight. Graeme Mears holds the wing because of the strong crosswinds

Dave Patrick and Graeme Mears pose with the Tiger Moth. The plane won in the Hardware, Team Scale and Most Realistic Flying Model classes. Not a bad haul!

entering a pattern event.

Let's talk a bit about mixing. Adverse yaw is common. This is the tendency of an aircraft to yaw in a direction that's opposite to the aileron input. This means that if you wanted to turn left and gave some left aileron, the plane would lower its left wing and yaw right. The amount of opposite yaw can vary and is sometimes so large that the plane will actually turn right rather than left. This is very common in full-size planes and many scale models. It's not that common in sport models because we design them so that they don't have this tendency, and this makes them easier to fly. There are a couple of fixes, and the Tiger Moth needed both!

By adjusting aileron throws to have more "up" than "down," we can minimize adverse yaw; adjusting them to have a 2:1 up/down ratio is not unusual. We can also mix rudder into aileron, so the ailerons are the "master" and "rudder" is the "slave." I have found this helpful, and I mixed just a bit, mostly by hand during the maneuvers. If I remember correctly, at Top Gun, I had about 10 percent or so rudder slaved to aileron. Still, to make a good coordinated turn, I had to add more rudder to make it look right. Too much mixing becomes a problem in other maneuvers, so use just a bit to help you out. But practice those turns using rudder!

LOOP

As mentioned previously, our research showed that it took a long, sustained dive to get to looping speed. And even at that, as with the full-size plane, at the top of the loop, there was almost no airspeed left!

So at cruise, push the nose down, then gently pull up (Figure 1). How much? Well, just enough to ensure that when you're at the top of the loop, almost all airspeed is gone; you need to learn how much through experimentation.

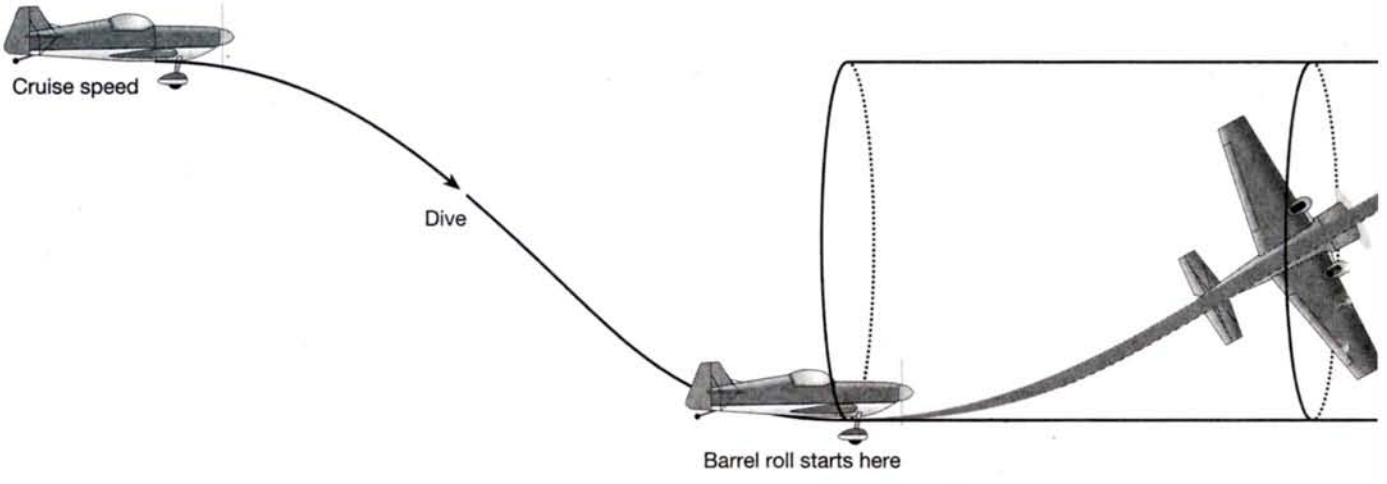
BARREL ROLL

There are variations on this, but basically, it's a roll with up-elevator added in—kind of like a spiral—and it's actually difficult to do well (Figure 2). First, pitch up the nose gently. As it passes through 20 degrees, you keep the up-elevator in and add both right aileron and a small amount of right rudder. To get the most scale planes—and certainly the Tiger Moth—to perform a large barrel roll slowly, rudder is necessary. As you approach the top of the roll (inverted), release most of the up-elevator, but not all, and start feeding it back in as you come around to upright. You want to avoid a "negative G." Keeping this in the back of your mind will help you execute this maneuver properly. It was first used to ensure that engines would continue to run throughout the roll because many full-size aircraft do not have inverted fuel systems. The Tiger Moth had a gravity feed fuel system with the fuel tank installed in the *top* wing. Needless to say, the Moth's engine didn't like to be inverted at all!

STALL TURN

This is a simple maneuver, but with a low-powered aircraft like the Moth, you really need to maximize energy (Figure 3). Get that speed up, or the up-line will be very short, and this will result in a recovery altitude that will be below entry. Another key is not to throttle all the way back on the up-line. At Top Gun, I throttled back to about 50 to 70 percent and kept it there by using the blast from the

Figure 2. Barrel roll.



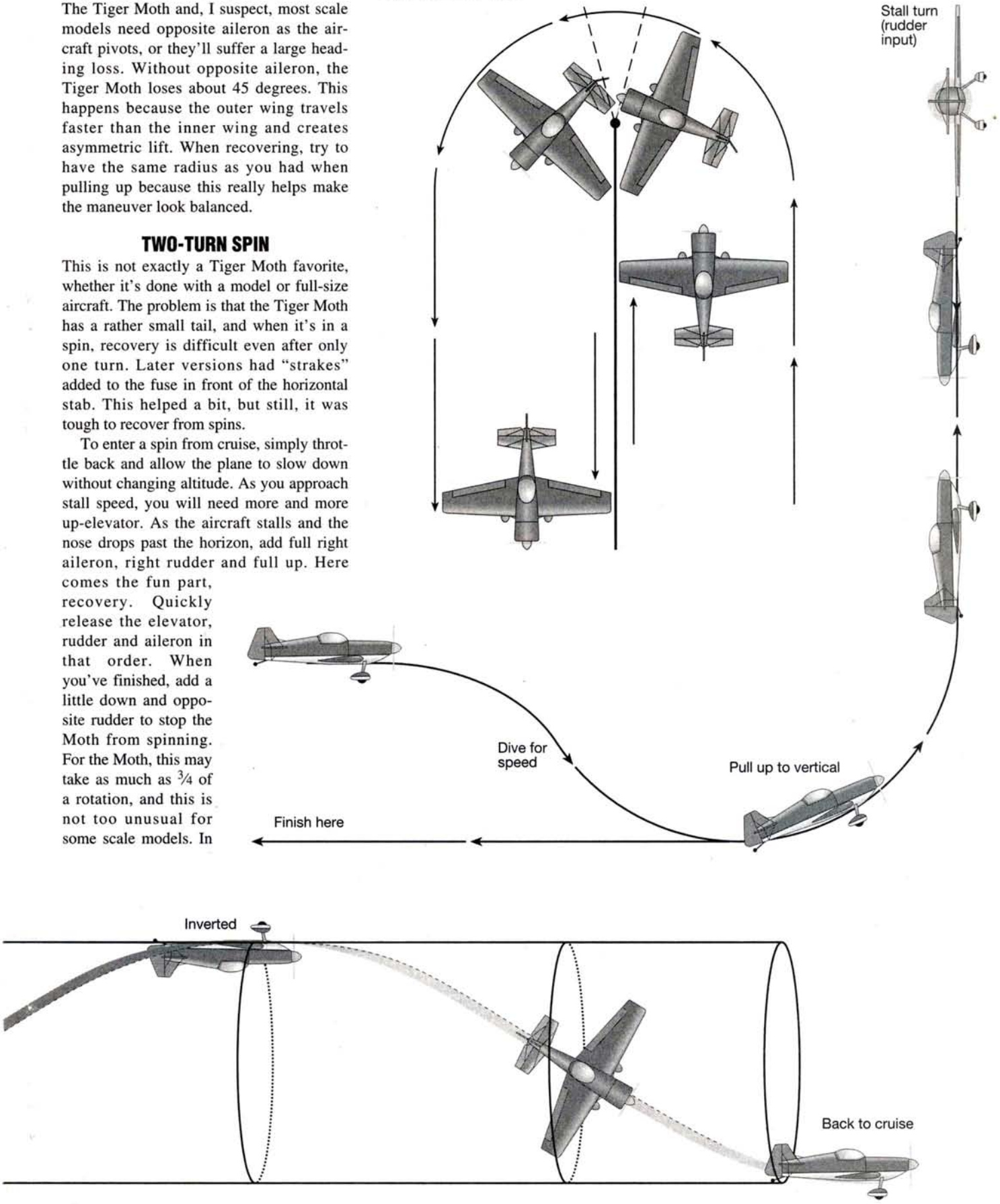
prop to help the rudder pivot the aircraft. The Tiger Moth and, I suspect, most scale models need opposite aileron as the aircraft pivots, or they'll suffer a large heading loss. Without opposite aileron, the Tiger Moth loses about 45 degrees. This happens because the outer wing travels faster than the inner wing and creates asymmetric lift. When recovering, try to have the same radius as you had when pulling up because this really helps make the maneuver look balanced.

TWO-TURN SPIN

This is not exactly a Tiger Moth favorite, whether it's done with a model or full-size aircraft. The problem is that the Tiger Moth has a rather small tail, and when it's in a spin, recovery is difficult even after only one turn. Later versions had "strakes" added to the fuse in front of the horizontal stab. This helped a bit, but still, it was tough to recover from spins.

To enter a spin from cruise, simply throttle back and allow the plane to slow down without changing altitude. As you approach stall speed, you will need more and more up-elevator. As the aircraft stalls and the nose drops past the horizon, add full right aileron, right rudder and full up. Here comes the fun part, recovery. Quickly release the elevator, rudder and aileron in that order. When you've finished, add a little down and opposite rudder to stop the Moth from spinning. For the Moth, this may take as much as 3/4 of a rotation, and this is not too unusual for some scale models. In

Figure 3. Stall turn.



other words, some scale models require that you do more than "let go" to recover from a spin. I also suggest that you try a one-turn spin before you try a two-turn spin, just to be on the safe side. Of course, do all spins at a safe altitude.

SNAP ROLL

I suspect that few scale pilots select the snap roll as an optional maneuver, but we thought it would be nice to be different, and frankly, it's fun! As it turns out, it was much more difficult to perform than it is with a conventional aerobatic plane. Scale models typically don't have the proportions that have been "designed into" our regular sport model aircraft to provide additional stability. The Tiger Moth's small tail size made recovery from a snap difficult. The Moth tended to continue snapping on its own after the controls had been released. I have flown scale Cubs, and they behaved similarly.

Let's walk through a snap. Again, you need plenty of energy, and this means diving again to gain sufficient speed. When you have sufficient speed ... oh ... what is sufficient? You need to be fast enough to complete the maneuver but not so fast that you tear the wings off. I suggest that you start at low speeds and very carefully work your entry speeds upward. When you have the proper entry speed, pull up to about 15 degrees, establish that "line," then quickly apply full up-elevator, full left rudder and full left aileron. The aircraft should snap (which is a stalling condition) quickly to the left. Now, recovery is what really makes scale models interesting. With a Tiger Moth, the pilot has to release the up-elevator and the left rudder as the aircraft passes through inverted, maintain the left aileron and then use the aileron to finish the snap and recover to level flight. The Moth takes a long time to recover from a snap, and a lot of "lead" is needed to execute the maneuver properly.

The plane taxis into takeoff position. Note the full aileron input needed to compensate for the very strong crosswind. Without it, the aircraft most certainly would have flipped during the taxi or takeoff run. How is that for nearly perfect grass?

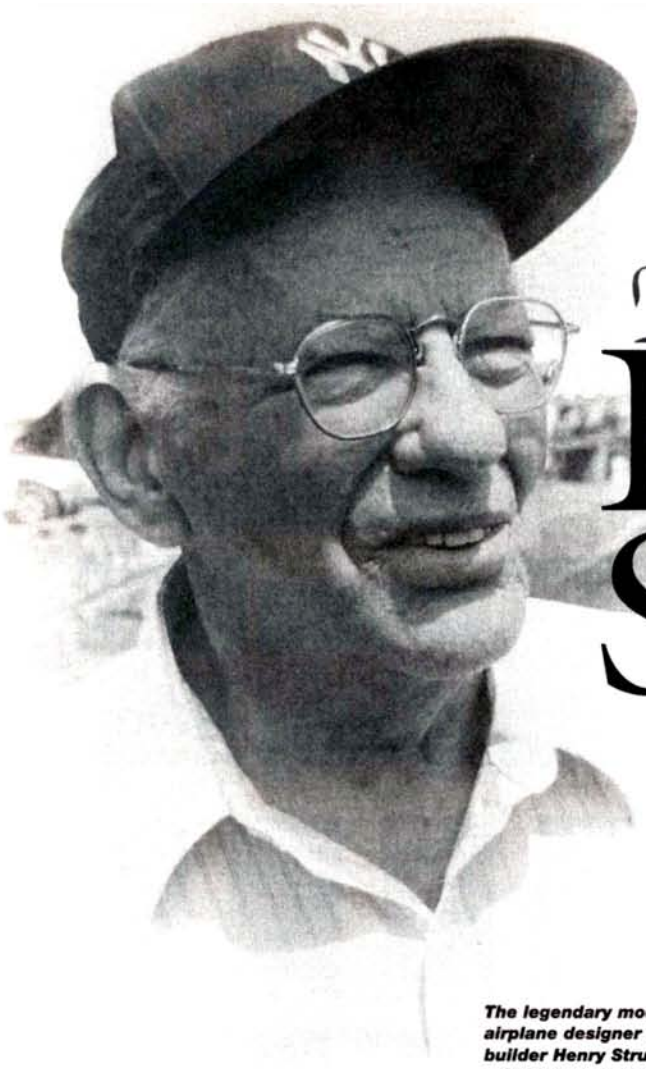
SUMMARY

I learned a lot from flying at Top Gun. Not only was it a great event, but also, I really enjoyed the new and different discipline. Scale flying *is* different and requires a different approach from pattern competition flying. You must fly the maneuver well, and it must be done as the full-size aircraft would have flown it. Research pays off bigtime, and flying and practicing sport aerobatics will improve your flight skills and make you a better scale pilot. Good luck, and enjoy your flying. Thanks, Graeme!

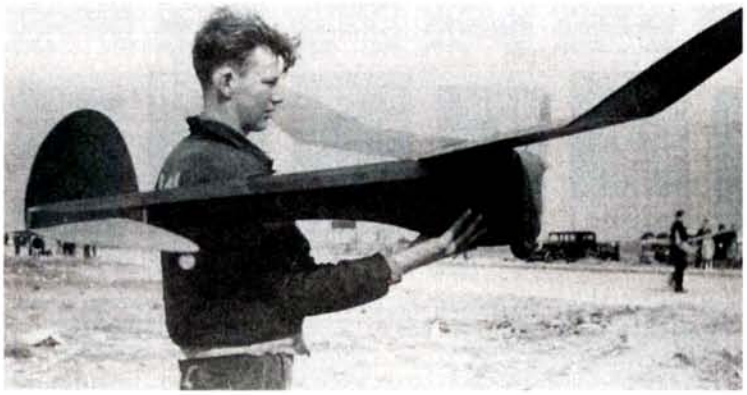
The HENRY STRUCK Story

by FRANK GUDAITIS

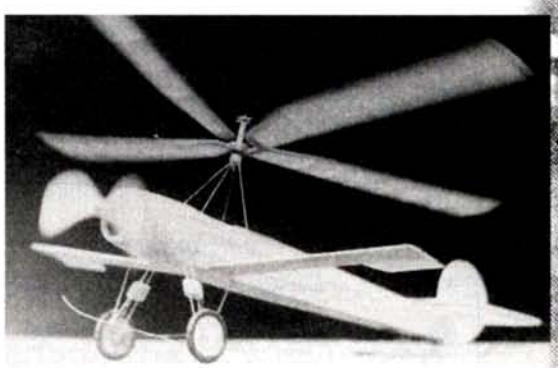
A lifetime of desig



The legendary model airplane designer and builder Henry Struck at a SAM meet in 1993.



Henry Struck (age 23) with his 1939 Nationals record-breaking, free-flight gas model "Record Hound." Construction drawings were published in a 1939 "Air Trails."



Struck's scale model of Juan de la Cierva's 1924 autogiro. Construction plans were published in the March 1940 issue of "Flying Aces."

OF ALL the pioneering model builders who distinguished themselves during the early days, none can approach the prolific record of world-class-champion Henry Struck. During the past 70 years, more than 100 of his successful (mostly scale) miniature airplane designs have appeared in several publications, including *Air Trails, Flying Aces* and *Model Airplane News*.

Henry inspired countless model builders of all ages. His designs included simple, rubber-band-powered stick models; delicate, ultralight, microfilm-covered, indoor, free-flight models; miniature rotary-wing aircraft; sailplanes; and many contest-winning, free-flight scale and R/C gas models.

Henry's first win dates back to 1931 when his scale model of a Fokker triplane won a Boy Scout contest. More wins followed, including one in 1933 with a model of the Stinson Detroiter full-scale airplane at a contest run by the "New York World Telegram." In 1936, his rubber-band-powered, scale model of a Davis monoplane won at the Eastern States contest.

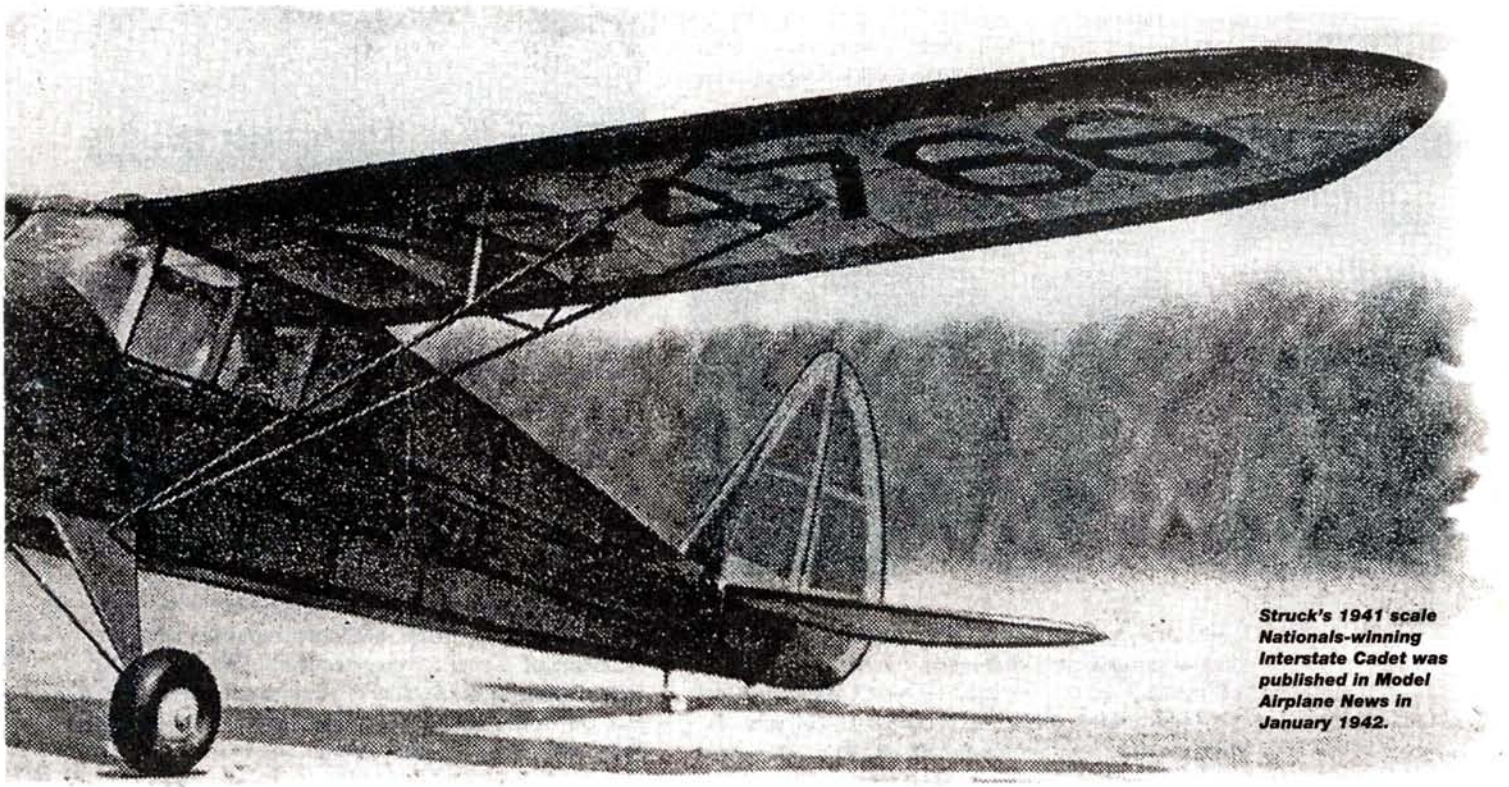
the Nationals. One year later, his gas model—aptly named "Record Hound"—set a free-flight record at the Nationals. Plans for building this plane were published in *Air Trails* that same year, and many model builders won local contests with this design. More than a half century later, the Record Hound is still very much alive and is being built and flown (with R/C assist) by members of the Society of Antique Modelers.

In 1950, at an event run by the National Aeronautic Association and held at the Alameda Naval Air Station in California, one of Henry's free-flight gas models set a world speed record of 88mph. The speed runs were flown in both directions and precisely timed by photo-

ning and building model airplanes

In 1938, 1941 and 1946, his diverse miniature airplanes won four national championships. In 1938, he set an endurance record for indoor cabin-model airplanes at

electric traps. This speed record stood unbroken for 20 years! Henry's high-speed, free-flight model was subsequently acquired by the Smithsonian's National Air

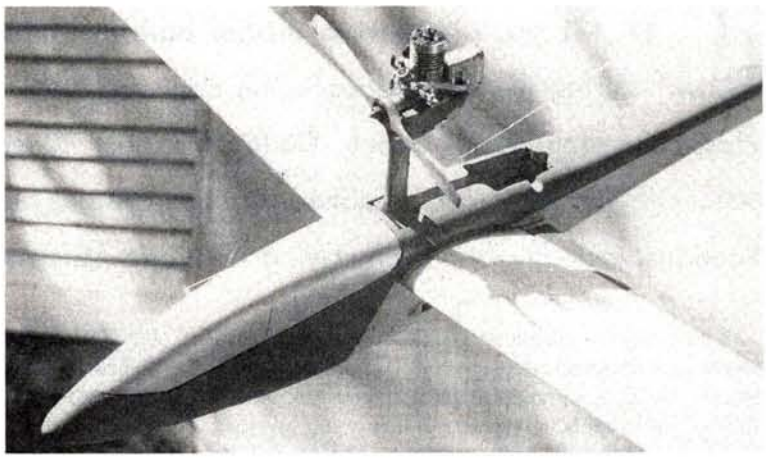


Struck's 1941 scale Nationals-winning Interstate Cadet was published in Model Airplane News in January 1942.

Museum and put on display in 1952.

In 1962, Henry's .020 PAA Load Design model won the Nationals once again. An incredible 48 of Henry's free-flight model airplanes were also manufactured in kit form by the notable Berkeley Company.

Looking back six decades, we can find many interesting, small, scale models. The country was then in the throes of a serious economic depression, and few modelers could afford to build large, complicated planes. Henry's small, rubber-band-powered models were all successful fliers and were well within the reach of most model builders. His series of models was published under the heading of "Trail Blazers of Aviation." They included copies of famous airplanes such as the Wright Flyer, the Curtiss Pusher, the Bleriot Channel Crosser, a Deperdussin seaplane, the Rumpler Taube, the Spad, the Fokker D-7, a Handley-Page bomber, the Vickers Gun Bus, the NC-4 Flying Boat, the Spirit of St. Louis and Juan de la Cierva's autogiro.

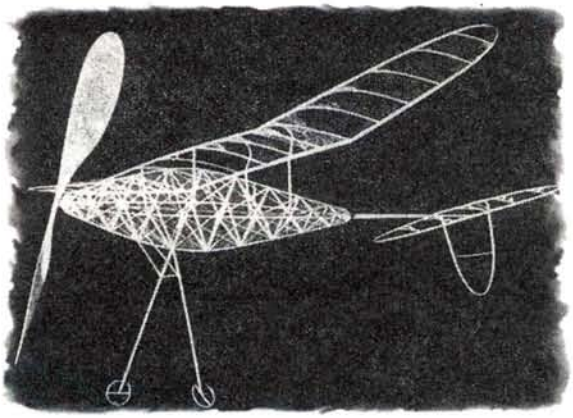


The "Eastwind" R/C sailplane—another Struck design—had a retractable engine that folded into the fuselage much like the full-size Nelson Hummingbird glider. The Eastwind was kitted by the Jetco Company.

The difference between these published designs and Henry's low-cost kits that were then commercially available was that Henry shared his "secrets" to building successful flying models. Kits from the published designs usually didn't include detailed building instructions—only simple 3-view plans and a few words. Ten of Henry's contest-winning models were published in *Model Airplane News,* including plans and instructions for duplicating four of his Nationals-winning, scale model airplanes.

During and after WW II, Henry worked on a number of full-size aircraft, including the CG4A troop-carrying glider and the PRG-1 U.S. Navy training sailplane. He also experimented with boundary-layer airflow. Some of his other designs included an aerodynamic autopilot for light aircraft and an experimental "polyphibian" with a retractable hydro-ski. He and the late August Raspet designed a G-load recording device, which eventually became the black-box recorder found in today's large aircraft.

Looking back, Henry fondly remembers many distinguished model builders with whom he had the privilege of working, e.g., Frank Zaic, Carl Goldberg, Ben Shereshaw, Joe Kovel, Bill Winter, Charles Grant, William Effinger and Louis Garami. Henry remembers getting Garami so hooked on building and flying model airplanes that Garami's radio-repair business suffered because of it. Louis Garami became a superb, innovative modeler.



Struck's 1938 indoor cabin Nationals winner was published in Model Airplane News in July 1939.

Today, when most men his age are content to relax and enjoy their golden years, Henry runs a small instrument company. The principal product is a unique gyroscopic stabilizer that's used with handheld cameras and other optical-sighting devices.

In recognition of his lifetime achievements in model aviation, Henry Struck has been inducted into the Academy of Model Aeronautics Hall of Fame and the Hall of Fame of the Society of Antique Modelers. He is also still active in the FAI Team Selection Committee and the Free Flight Contest Board.

Mr. and Mrs. Henry Struck with Dr. Paul Garber (left) and Henry's free-flight gas model that set a world speed record of 88mph and was exhibited at the Smithsonian's National Air Museum in 1952.

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1997. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 100 East Ridge, Ridgefield, CT 06877-4606.

1/5-SCALE DELUXE

Lynn Sidabras of Milwaukee, WI, modified Ikon N'West plans to 3-views to construct his true-to-scale 1941 Taylorcraft BC-12. The 90-inch-span model features functional doors and a complete interior with a full-body pilot, seat belts and handholds. It weighs 14½ pounds, is powered by an O.S. 1.20 4-stroke and is covered with 21st Century fabric. Lynn spent close to 1,000 hours over three years to complete the model.

HOOVER CRUISER

Bob Hoover inspired modeler Jim Tucker of Buncombe, IL, to construct this Shrike Aero-Commander. A Bridi kit that was produced in the late '70s, it features a fiberglass fuselage, foam flying surfaces and a torque-tube system for flaps and ailerons. The model's 80-inch wingspan supports two SuperTigre 45s. Controlled through JR X347 and Futaba servos, the Commander has also been customized with Rhom Air rotating mains and a Goldberg mechanical nose gear.

HOWARD GIANT

Al Martens of British Columbia, Canada, scratch-built and designed this 12½-foot-span D.G.A. Howard and spent nine years testing and perfecting the first version, then worked on the redesign for two more years until bigger engines and stronger servos became available. When the German 3W 3-cylinder, 11hp engine was released, Al knew that it was just what he needed. He's happy to report that the Howard "flies as good as it looks."

WAR-WEARY WARHAWK

Kjell Hagen of Narvik, Norway, sent this photo of his Top Flite P-40 Warhawk. It's covered with fabric and painted with polyurethane; the Chinese military markings are decals. It also has Robart warbird legs and tires and is powered by an O.S. .91 Surpass 4-stroke. Kjell modified the flaps to be split, just like those on the full-size airplane.

MODEL AIRPLANE NEWS

FIELD & BENCH REVIEW

GLOBAL QUALITY KITS

RAVEN

FUN FLY 40

A PROFILE AEROBAT

PERHAPS ONE of the most attractive aerobatic airplanes performing today is Wayne Handley's Raven. With its distinctive "blackbird" markings over a red upper fuselage, the Raven is instantly recognized by many modelers. Global Quality Kits* has the exclusive license to manufacture models of the Raven and at this time offers two versions—a built-up .60 to .90 size and an outrageous .40-size fun-fly profile model, the subject of this review.

THE KIT

The high-quality kit offers well-shaped parts that fit together easily. Begin with the horizontal stab, which you assemble directly over the plans.

• **The stab.** It consists of only 13 parts and is quickly built. There are six parts for each elevator; the completed elevator halves are joined with a 1/4-inch-diameter dowel; nothing to trip you up here. The vertical fin and rudder are also simple to build. Next is the wing.

PHOTOS BY GERRY YARRISH AND TOM ATWOOD

• **The wing.** Remember that the wing is built upside-down over the plans. Start by pinning down the leading-edge (LE) and trailing-edge (TE) sheeting as well as the 1/4-inch-square spruce spar. The spar should overhang the aft edge of the LE sheeting by 1/8 inch. When this has been done, glue the 1/4x5/16-inch TE piece to the TE sheeting (the 1/4-inch-wide side

SPECIFICATIONS

Name: Raven Fun Fly 40

Manufacturer: Global Quality Kits

Type: profile sport

Wingspan: 53 in.

Airfoil: symmetrical

Weight: 5 lb., 5 oz.

Wing area: 848 sq. in.

Wing loading: 14.6 oz. per sq. ft.

Channels req'd: 4 (aileron, rudder, elevator, throttle)

Radio used: Futaba 7UAPS

Engine req'd: .40 to .53 2-stroke

Engine used: Magnum .40

List price: $89.95

Features: all-wood, one-piece design with a profile fuselage; includes die-cut balsa, plywood and lite-ply parts, aluminum landing gear, clear plastic canopy, spinner, decals, one set of full-size plans, illustrated instruction manual and all screws, washers and nuts.

Comments: as a profile fuselage design, it's very quick to build and has great flight performance. Its thick, symmetrical airfoil gives it very good slow-speed characteristics.

Hits
- Fast and easy to build.
- Great decal set.
- High-quality hardware package.

Misses
- The servo-hatch design needed modification (see text and editor's note).

should face the building board), and glue the ribs into place. Note that the rib-number callouts should be right-side up.

With the ribs in position, add the balsa LE as well as the second 1/4-inch-square spruce spar. Now laminate the half rib parts together, and glue them to rib R-1 as shown in the illustrations. Make sure the holes in the half ribs precisely match those in R-1.

Remove the wing from the building board, and trim the LE sheeting so it butts tightly against the rear of, and is flush with, the leading edge. Glue the sheeting into place; do the same for the second LE sheeting. Next, add the TE sheeting; take care and don't glue it to the half rib attached to R-1. The sheeting should fit snugly against the wing's TE. Then add the vertical-grain shear web to the spar, and complete the wing's center-section sheeting between ribs R-1 and R-2. Flip the wing over, apply the rib cap-stripping, and glue the die-cut servo-mounting platform support into place on top of R-1 and R-2. Sand the wing smooth, and repeat the process for the second wing panel. Don't build two left panels!

The servos are mounted on the bottom of the wing panels and are easy to adjust. The servo-mount plates act as access hatches.

Like the tail surfaces, the 1/4-inch-thick ailerons are simple to build; assemble them over the plans.

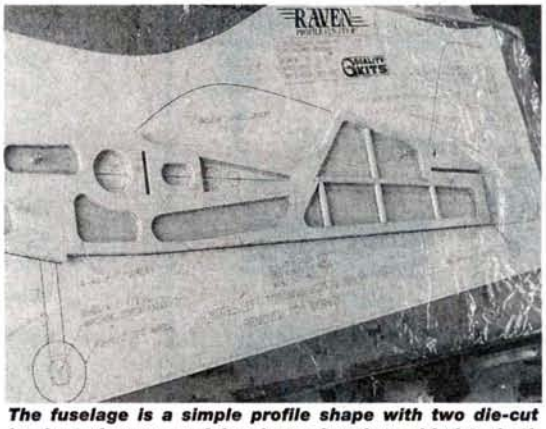
To finish the wing panels, cut a slot in each R-1 rib between the spars to accept the plywood wing brace, add the wingtip plates, hinge the ailerons to the wing panels, and build the servo tray and fit it onto the wing. The servo tray is made of 3/32-inch-thick balsa sheeting and a lite-ply doubler. The tray fits into place on the wing and acts as the bottom center-section sheeting. The aft end of the tray has two protruding tabs that fit behind the servo-platform support; the tray is secured in place with two screws at its front edge. The screws go into two lite-ply gussets glued to the rear of the spar and to the inner sides of R-1 and R-2.

Far left: the Magnum 40 is easy to mount in the profile fuselage. The fuel tank is inside the left wing. Center: the aluminum landing gear is simply bolted to the fuselage—simple design. Left: at the field (left to right)—Gerry Yarrish, Roger Post Jr. and Larry Marshall prepare the Raven for another test flight.

It is here that I found the only problem with the instructions. You'll have to add a capstrip to rib R-2 to support the covering material and a simple balsa doubler strip to the rib's inner side to support the tray.

• **Fuselage.** To construct the fuse, begin by laminating two die-cut center cores with 30-minute epoxy. To ensure a straight fuselage,

place the core on a flat surface and weigh it down until the epoxy has cured; then place the core over the plans and pin it into place. Now glue the ¼-inch-square balsa stringers into place. When the glue has dried, remove the core from the building board, and sand it flat and smooth with a sanding block and 220-grit paper. Now glue the fuse side sheeting pieces together and when the glue has dried, sand it smooth with a sanding block. Glue the fuselage sides to the core with 30-minute epoxy, and weigh the fuselage down on a flat surface until the epoxy has cured. Next, add the landing-gear pads and the engine-mount plate. Finally, sand the fuselage to shape, and add a radius to the top and bottom edges. *[Editor's note: these parts and instructions are now included in all kits.]*



The fuselage is a simple profile shape with two die-cut laminated cores and fuselage sheeting added to both sides. Plywood pads support the landing gear and a plywood plate for the engine mount.

• **Wing brace.** The wing panels are attached to the fuselage with a laminated wing brace. Epoxy together the two parts of the brace, sand them to shape and insert them into the wing-brace slot in the fuselage. When you glue the brace into the slot, make sure it is at a 90-degree angle to the fuse at its upper edge. Check this with a square. You'll have an easier time with the covering if you cover the fuselage now, before the wing panels are attached. But if you do this, be sure to remove the covering where the wing panels will come into contact with the fuselage sides.

Slide the wing panels onto the brace and butt them up against the fuselage. The half rib glued to rib R-1 fits into a wedge-shaped opening in the fuse and will set the wing's incidence. Use 30-minute epoxy to glue the panels into place.

• **Landing gear and engine.** Using the plans as reference, place one of the aluminum landing-gear legs on the fuse, and mark the position of the mounting holes. Drill the ⅛-inch holes through the fuselage, and attach the gear with 4-40 machine screws, washers and nuts.

To position the engine-mount holes, put the engine in the engine mount, and trace the holes in the mount lugs onto the engine-mount plate. Drill out the holes with a ⅛-inch drill bit; then install 4-40 blind nuts in the holes in the left side of the fuselage. Test-fit the engine, and when you are satisfied with the fit, remove it until you have covered the fuselage.

FINISHING

To cover the model, I used 21st Century* film; I applied it to the tail surfaces before I glued them to the fuselage. The fuel tank's vent and fuel-outlet tubes exit the wing through the upper LE sheeting—a neat installation. Use a shaping knife to trim to size the decals that come with the model before you apply them to the covered model. I used a soap-and-water solution to "float" the decals into position and a small piece of balsa sheeting to squeegee the solution out from under them.

FINAL ASSEMBLY

Hinge all the control surfaces, and glue the hinges into place. Roughen the hinges with sandpaper so the epoxy holds better. Install

FLIGHT PERFORMANCE

by ROGER POST JR.

I had already flown other high-performance fun-fly planes, so I sat down with the Futaba Super 7 and programmed the throws on the Raven's surfaces. High rates now had ridiculous amounts of throw, and low rates had the manual's suggested high-rate throws.

• Takeoff and landing

The Raven is light, so it will take off in a few feet of runway with a power setting just above ½. It can also be allowed to "fly off" on its own with the throttle setting at ⅓, but this requires a slightly longer takeoff run. I recommend this method for those who haven't flown a plane like this before. At these low power settings, a slight amount of right rudder was needed to keep the plane tracking straight. It needed quite a bit of left-aileron trim for the wings to remain level. This was probably because of the full fuel tank in the right wing. When you balance your model side to side, fill the tank halfway; this will keep the need for aileron trim to a minimum. Balanced this way, in the beginning, your plane will need some left-aileron trim; as the tank empties, you'll find yourself adding right-aileron trim.

Landing this plane is akin to landing a feather. Head it into the wind, place it over your field and control the descent with the power. You can basically hover-land it in the slightest breeze. For normal approaches, chop the throttle, re-trim the elevator and fly it to the touchdown point. Adding the flap-to-elevator coupling, and the flaps as airbrakes controlled by the throttle stick (you must reverse the direction of the airbrakes so that the flaps go down) does much to enhance the Raven's performance during landings.

• High-speed performance

The Raven will fly fairly fast but is better suited to up-close, "in the box" maneuvers that require throttle management. The power-on stall needed the throttle reduced to ½ to make it happen, and the Raven just falls ahead and keeps on flying. To keep the wings level during the stall, add in some right rudder and aileron.

• Low-speed performance

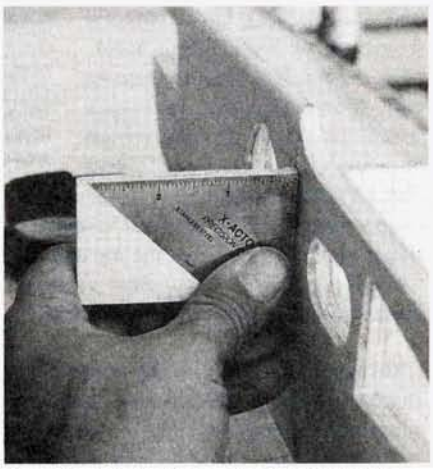
Drop the throttle to idle, point the plane into the wind, add some up-elevator and a little right rudder, and the Raven will stand still. How's that for low-speed performance! During power-off stalls, the Raven just "mushed" ahead with no discernible break.

• Aerobatics

The Raven is extremely aerobatic, but also short-coupled, so some maneuvers will happen faster than you expect. It didn't roll as fast or loop as tightly as some of the "stik-it"-type fun-fly planes, but its speed was still fast enough to provide some excitement for the pilot. All combinations of spins and inverted maneuvers are easy to accomplish, and the Raven's abilities are limited only by the "knowledge" of your thumbs.

the wheels and axles on the main landing gear, add the tailwheel and install the engine, prop and spinner. Glue the canopy into place With Pacer's* Formula 560 canopy glue, and add the control horns.

Install the receiver and batteries as shown on the plans, and install the servos in the servo trays in the bottom of the wing. The elevator, rudder and throttle pushrod housings are secured to the fuselage with



When you install the wing-support brace, be sure its upper edge is 90 degrees to the fuse side.

landing-gear straps and screwed into place. The music-wire pushrods slide inside the outer housing. Install the control linkages as shown, using a Z-bend or kwik-connector to connect the pushrods to the servo-output arms and a clevis at the control surfaces. Mount the radio on/off switch in the left wing panel; connect your radio system and check for correct control throws and direction. The suggested control throws are as follows:

- Ailerons and elevators: ½ inch up and down (high rate), ⅜ inch up and down (low rate).
- Rudder: 1½ inches left and right (high rate), 1 inch left and right (low rate).

Be sure to balance the Raven as shown on the plans, with everything installed but without fuel in the tank. When you are satisfied, all you'll need to do is to charge the batteries and head for the flying field

Overall, the Raven is a good-looking model that performs very well. Its profile fuselage, reminiscent of the early U-control model design many of us grew up with, greatly simplifies and speeds construction. If the Raven could talk, it would say to sport models, "Nevermore!"

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.*

MODEL AIRPLANE NEWS
ENGINE REVIEW

Enya .41-4C

A 4-stroke for sport fliers

by MIKE BILLINTON

Enya Metal Products has acquired a reputation for consistently high quality by providing a wide range of 2-stroke engines for aircraft, helicopter, car, marine and C/L applications (35 basic units) as well as 4-stroke engines (nine-units). The new .41 4-stroke fills a gap between Enya's earlier .35 and the later .46 4-strokes. Designed for R/C sports aircraft, the .41 4-stroke improves on the 4-stroke's power/weight ratio because its power output equals that of the larger engine, but it's similar in size and weight to the smaller .35.

DESIGN AND CONSTRUCTION

Using the same 17mm stroke as the early .35 and with a much enlarged bore of 22.3mm, the engine has an over-square ratio of 0.759:1. Its larger bore allows the use of larger overhead poppet valves (8.29mm head diameter) behind which are port throughways of 7.6mm diameter.

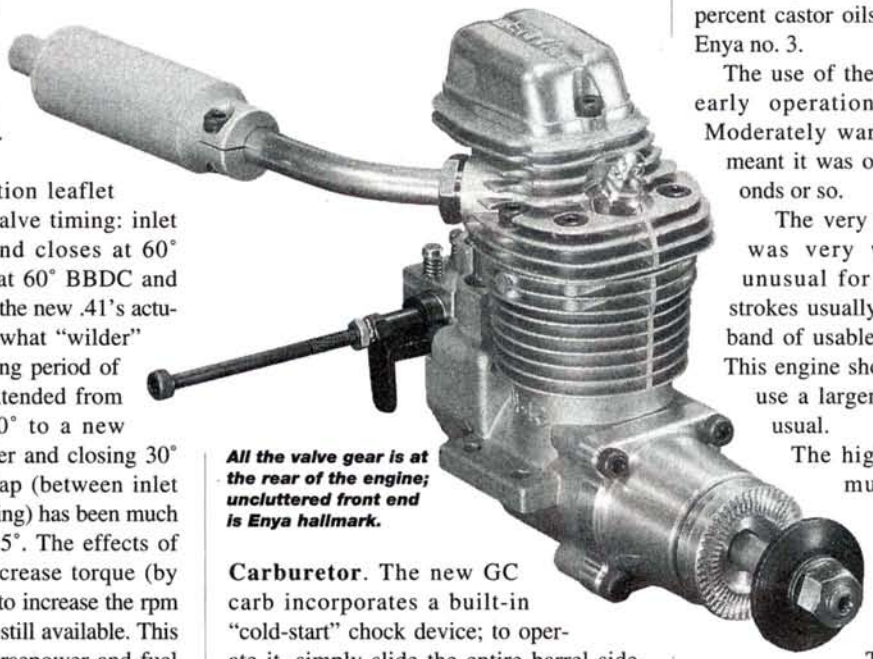
• **Timing**. The instruction leaflet shows mild, standard valve timing: inlet opens at 20° BTDC and closes at 60° ABDC; exhaust opens at 60° BBDC and closes at 20° ATDC. But the new .41's actual valve timing is somewhat "wilder" than that: the total opening period of both valves has been extended from the earlier mold's 260° to a new 320°—opening 30° earlier and closing 30° later. So the new overlap (between inlet opening and exhaust closing) has been much increased from 40° to 95°. The effects of these changes are to increase torque (by increased breathing) and to increase the rpm at which higher torque is still available. This causes an increase in horsepower and fuel consumption.

• **Cylinder and crankshaft**. The cylinder head has an angled, "pent-roof" combustion chamber and is set at a compression ratio of 6.9:1, which can be reduced further to 6.18:1 if the additional 0.016-inch gasket is used. These low figures suggest that the new valve timings were expected to increase breathing and, therefore, to cause higher cylinder pressures; so the compression ratios have been lowered to avoid detonation.

The solid-aluminum front-crankshaft housing is fitted with a rear main ball bearing.

A hardened-steel cylinder liner is used with a high-duty/high-expansion aluminum-alloy piston that has a single, cast-iron ring. Diametrical piston clearances within the liner are the necessary 0.0035 inch at the skirt and 0.0045 inch at the crown. The aluminum-alloy connecting rod is phosphor-bronze-bushed at both ends.

• **Cam drive**. The twin cam drive is by means of a supplementary thin crankweb supported on ball bearings in the rear cover, which also houses the outer cam bearings and pushrod cam followers.



All the valve gear is at the rear of the engine; uncluttered front end is Enya hallmark.

Carburetor. The new GC carb incorporates a built-in "cold-start" chock device; to operate it, simply slide the entire barrel sideways in the carburetor body. This allows extra fuel to be admitted and it closes the air throughway to produce the required richer fuel/air ratio for cold starting.

• **Other controls**. These include the standard main fuel needle, the throttle stop (for setting the idle level) and the air-bleed screw (which controls the fuel/air ratio for idling). Because the screw adjusts the amount of air, it should be closed to richen the mixture. Note that this is the opposite of the usual idle fuel needle, which, when closed, effectively leans the mixture by reducing the amount of fuel in relation to the air supply, which is kept constant.

PERFORMANCE

A wide range of propellers was used during the one-hour running-in period and to assess the engine's general performance and handling. When turning high-load props, there was no trace of the detonation that Enya said was possible. The engine did quit at lean needle settings; when that happened, enriching the needle valve by about a half to three-quarters of a turn restored the fuel setting to the correct, slightly rich" area and ensured reliable operation.

• **Test 1. Open exhaust.** *Fuel*—10 percent nitro, 10 percent ML70 synthetic with 7 percent castor oils, and methanol. *Plug*—Enya no. 3.

The use of the cold-start choke made early operations relatively simple. Moderately warm ambient conditions meant it was only necessary for 5 seconds or so.

The very wide, flat, torque band was very welcome and highly unusual for a model 4-stroke (4-strokes usually have a much narrower band of usable torque than 2-strokes). This engine should certainly be able to use a larger range of props than is usual.

The high rpm at which maximum horsepower was achieved indicates that Enya's recommended speed range of 8,500 to 13,000 rpm is conservative. The engine charged smoothly past 15,500rpm (the point at which I stopped) and operated well at around 7,000rpm.

• **Test 2. Standard muffler**. *Fuel and plug*—same as in Test 1.

The muffler is a small "straight-through" absorption unit without internal baffles. I thought it would have little effect; it did, however, seem to reduce noise inside my "dynamometer room."

PHOTOS BY MIKE BILLINTON

WEIGHTS AND DIMENSIONS

Capacity	0.40429ci (6.625cc)
Bore	0.8785 in. (22.32mm)
Stroke	0.667 in. (16.9418mm)
Stroke/bore ratio	0.759:1
Timing periods—inlet	Opens—46° BTDC
	Closes—88° ABDC
	Inlet total—314°
—exhaust	Opens—93° BBDC
	Closes—49° ATDC
	Exhaust total—322°; overlap—95°
Combustion volume	1.12 cc average
Compression ratios	Geometric—6.9:1 average
Cylinder-head squish	0.035 in. (0.089mm)
Cylinder-head squish angle	0°
Squish-band area	0.140 sq.in. (90.3 sq. mm)
Carburetor bore	0.22 in. (5.58mm)
Crankshaft diameter	0.3935 in.(10mm)
Crankpin. diameter	0.2165 in. (5.5mm)
Crankshaft nose thread	0.247 in. x 28 TPI (¼ INF)
Wristpin. diameter	0.1965 in. (5mm)
Connecting-rod centers	1.146 in. (29.12mm)
Engine height	3.71 in. (94.23mm)
—width	1.77 in. (44.96mm)
—length	3.76 in. (95.54mm)
Mounting-hole dimensions	1.476x0.59 x0.140 in. (37.5x15x3.54mm)
Width between bearers	1.184 in. (30.09mm)
Frontal area	5.1 sq. in.
Weight	Bare—13.5 oz. (383gm)
	W/muffler—13.9 oz. (394gm)
Crankshaft weight	1.45 oz. (41 g)
Piston and ring weight	0.22 oz. (7g)

PERFORMANCE

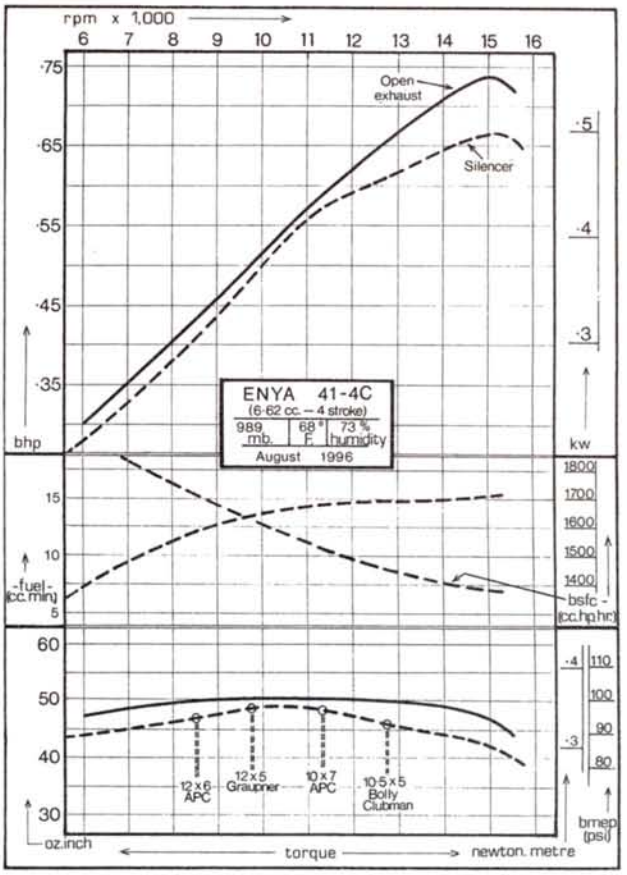
Max. B.hp	0.74 @ 14,900 rpm (open exhaust/10% nitro)
	0.67 @ 15,200rpm (standard muffler/10% nitro)
Max. torque	51 oz.-in. @ 10,600rpm (open exhaust/10% nitro)
	49 oz.-in. @ 10,300rpm (standard muffler/10% nitro)

Hits
- Good power-to-weight ratio
- Very wide, flat torque band

Misses
- None found

Comments: the new Enya .41 4-stroke is a well-engineered design for reliable sport flying.

The rear main ball bearing acts as "locater" into crankcase. The piston and front housing have been machined out of solid aluminum alloy. The cam drive and cams have been hardened.



RPM ON STANDARD PROPELLERS

	Open Exhaust	Standard Muffler
14x7 Graupner	5,100	5,070
12x7 Mastro	7,240	7,160
13x6 Top Flite	7,450	6,950
13x6 MK	7,720	7,460
12x6 APC	8,690	8,540
10x9 APC	9,780	9,530
12x5 Graupner	9,790	9,740
11x6 Graupner	9,815	9,750
10x8 APC	10,740	10,562
10.5x6 Graupner	10,970	10,840
10x6 MK	11,080	10,790
10.5x6 Bolly Clubman	11,120	10,860
10x7 APC	11,560	11,270
10.5x6 Bolly Clubman	13,080	12,726
9.5x6 Bolly Clubman	13,740	13,344
PERFORMANCE EQUIVALENTS		
B.hp/ci	1.83	1.66
B.hp/cc.	0 .11	0 .10
B.hp/b.	0 .87	0.77
B.hp/kilo	1.93	1.70
B.hp//sq. in. frontal area	0.145	0.13
Oz.-in./ci	126.1	121.20
Oz.-in./cc	7.7	7.39
Oz.-in./lb	60.5	56.40
Nm/cc	0.055	0.053

Manufacturer: Enya Metal Products Co., Ltd., Tokyo, Japan.
U.S. distributor: Altech Marketing, P.O. Box 7182, Edison, NJ 08818-7182.

The power graph and the prop rpm figures confirm that the muffler does have a restrictive effect. The final decibel (dB) figures show that even at around 9,700rpm, the engine/muffler combination meets the required restrictions of 82dB at 7 meters (U.K.) and 90dB at 9 feet (USA). Compared with open-exhaust figures, power was only slightly lower while high-rpm operation was slightly enhanced.

Enya's stated fuel-consumption figures of 18/20cc/minute, are higher than my tests showed. This probably reflects the extra-safe, rich settings advised and the in-flight throttle variations (neither of

ENYA .41-4C SPORTS 4-STROKE

which are features of normal, constant-rpm maximum-power testing).

• **Idling**. A Graupner 12x5 prop and the 10-percent-nitro test fuel allowed idling down to 2,700rpm. Attempts at lower rpm led to the plug's gradual cooling off. If the plug were kept lit by a normal battery supply, rpm down to 2,100 could be maintained.

SUMMARY

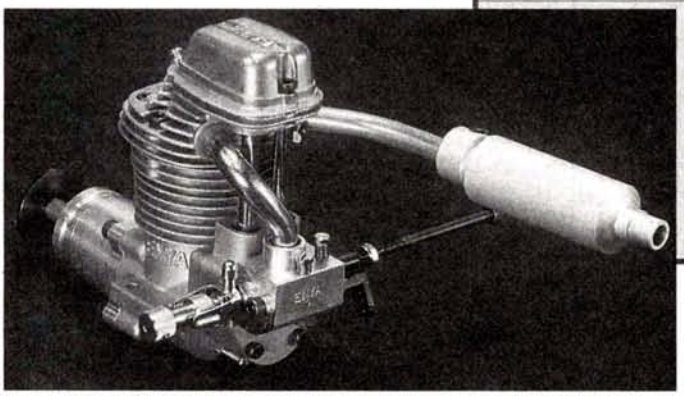
At the end of the tests, the compression seal had markedly improved, and all the runs, including final dB and idling checks, were performed at very steady rpm levels. I expect this particular .41 4-stroke to have a long, reliable life as a strong sport performer.

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.*

Enya .41-4C Sports 4-stroke dB levels	Wind 3mph				
9 feet at AMA/USA	Graupner 12x5 (9,700 rpm)	92	94	88	91
	Bolly Clubman 10.5x5 (12,700 rpm)	97	99	94	97
7 meters at BMFA/U.K.	Graupner 12x5	83	82	78	81
	Bolly Clubman 10.5x5	91	88	83	84

Engine: Enya .41-4C (.404ci 4-stroke)
Equipment: standard muffler
Fuel: methanol with 10% nitro
Temperature: 66°
Humidity: 70%
Pressure: 995mb
Meter: Radio Shack type 33-2050 using GA601 calibrator set to NPL standards
Height: meter and engine set approximately 1 meter above concrete
Location: outdoors, next to farmland

dB meter



Here, the air-bleed idler hole is at rear of the carb. This relatively small 4-stroke muffler just meets regulation noise levels.

MODEL AIRPLANE NEWS

FIELD & BENCH REVIEW

HOBBICO

EXTRA 300 ARF

Extra fun in a .60-size package

by ROGER POST SR.

FOR THOSE OF you who have been looking for an intermediate-size sport-scale Extra 300, Hobbico has a model that fits the bill. The new .60-size Extra 300—from the ASAP series—is an excellent ARF that's easy to transport and will be a nice addition to any aerobatic aircraft collection. After 40 years of modeling, I've at last built an ARF kit. At first, I was hesitant, but the kit's high quality made the experience a real pleasure. One thing that rings true for any building project—ARF or regular kit—is that you should read the instructions thoroughly and trial-fit all the parts before you begin to build. This M.O. saved me some time.*

CONSTRUCTION

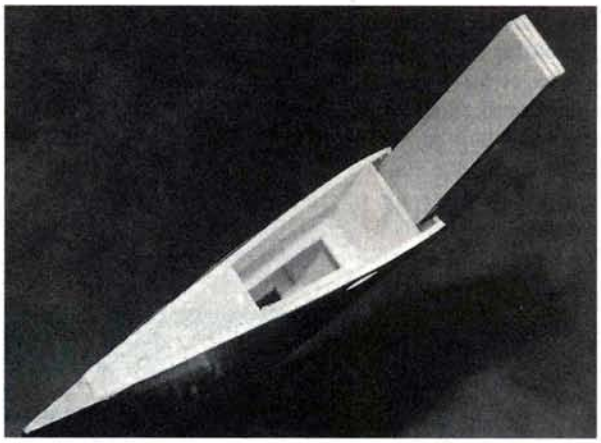
• **Wing.** The only problem I encountered was with the three wing-joiner pieces. They were too warped and twisted to use, so I replaced them with two pieces of aircraft plywood that, when laminated together, matched the thickness of the completed original joiner. I glued them together and then cut them to match the wing-joiner pattern. After that, wing assembly was a breeze.

When following step 6, be sure that the punch marks of the trailing-edge plate face upward and that you drill in steps 7 and 8 are perpendicular to their respective surfaces. In step 11, I used Great Planes* 30-minute epoxy, rather than the recommended 6-minute epoxy. This gave me more time when I placed and centered the bottom, plastic, center wing fairing. I also added epoxy to the servo trays in each wing half. They appeared to have been hot-glued into place, but I thought the extra security was a wise idea. A small addendum that concerns the gluing of the hinges is inserted in the instructions. If your plane has CA-style hinges, check to see that they are firmly attached. If they aren't, apply Great Planes thin CA to the hinges when the assembly procedure calls for it.

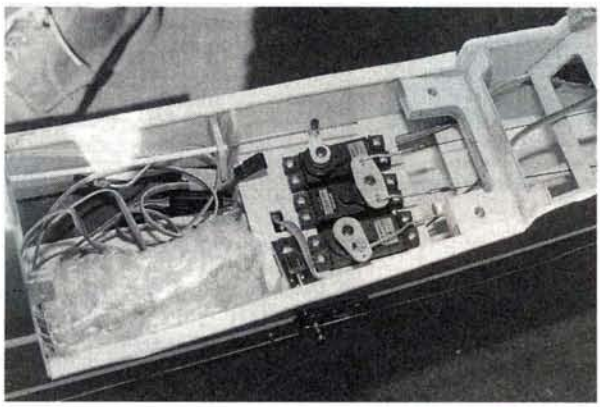
• **Fuselage.** Because the instructions are thorough and so much of the work has already been done for you, I'll just touch on the important features of the fuselage assembly. In most of the construction steps, bold print highlights an important facet of the step. Read the instructions carefully. In step 6, the bolt size is 4x20mm, *not* 3x12mm, and the 3mm flat washers *should* be 4mm locking washers instead. In step 12, I used 30-minute epoxy instead of 6-minute; this allowed a longer setup time when I lined up the horizontal stab. As always, the alignment of the horizontal and vertical stabs is extremely important. Take your time, and make sure that they are set properly; your model will fly truer when they are.

PHOTOS BY TOM ATWOOD AND GERRY YARRISH

In step 26, the plastic disks are drawn in the wrong spot. They *should* be between the horizontal stab and the aluminum flying wire. It's also necessary to drill out the holes in the disks to 1/8 inch so that they will fit over the brass tube inserts. I had to leave one washer off each of the three bolts that are used in step 27, because the 2x16mm bolts were a little too short. If you can, use 2x18mm bolts and file off any excess length.



The .60-size Extra 300 wing is made of three pieces of thin plywood laminated together. The pieces in my kit were too warped to use, so I made my own out of two pieces of 3/16-inch-thick aircraft plywood (also laminated together). I used Great Planes 30-minute epoxy to assemble the wing halves.

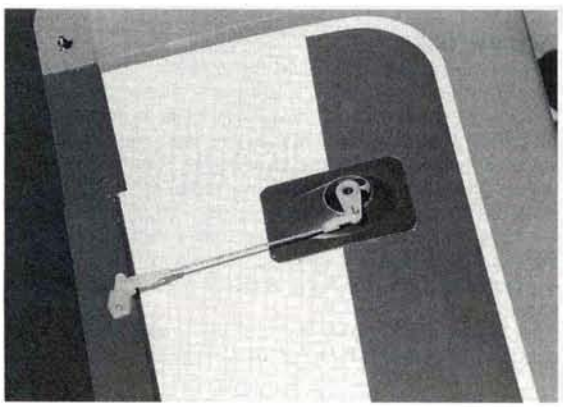


Typical of most ARFs, the fuselage has plenty of room for the radio gear, and the servos are mounted on a plywood tray that's glued into place as shown.

• Pushrods and servos. The installation of the control horns and pushrods is very straightforward. Follow the instructions, and you'll have no problems. The elevator pushrod is of the "Y" variety, and the wire end that is attached to the servo is attached to the side of the pushrod. The rudder uses a pull/pull system, so its servo has to be mounted in the middle of the servo tray. This puts the elevator servo off to the left side of the plane and sends an unequal push to the elevator halves. You'll have to adjust the elevator linkages so that the elevators deflect evenly in both directions. I had to put a shallow Z-bend in the rod that is attached to the elevator servo arm because leaving it straight put too much downward pressure on the servo's center shaft. Du-Bro's* heavy-duty servo arms (the JR type) were used on all the servos except the throttle servo.

In step 22, I used a 0.067-inch drill bit (rather than the recommended 5/64 inch) to enlarge the servo-arm hole. This change provided a tighter fit of the wire in the hole.

• Engine and fuel tank. For power, I used the Thunder Tiger* F-.91S 4-stroke engine with a Thunderbolt no. 3 high-performance glow plug. Because I was unable to reverse the orientation of the carburetor, I had to re-drill the hole for the throttle-pushrod tube. This put the throttle linkage at an awkward angle, so instead of using the supplied wire pushrod, I used a piece of the flexible brass cable with a Du-Bro ball link attached to the carburetor arm. These ball links are great for reducing linkage binding in a pushrod setup.



The aileron servos are mounted in the wing panels and use a short pushrod to move the control surface. A formed-plastic servo cover is glued over the servo to improve looks and airflow.

In step 4 of the engine installation, it *should* read "3mm nuts and lock washers," not "4mm nuts." The fuel tank fits into the fuselage snugly; I placed some foam between the tank and the piece of scrap balsa used to hold it in place.

When all of the linkages are hooked up, turn on the radio and set the recommended control-surface throws.

SPECIFICATIONS

Model: .60 ASAP Series Extra 300

Type: ARF aerobatic sport plane

Manufacturer: Hobbico

Part no: HCAA2605

Wingspan: 63 in.

Wing area: 667 sq. in.

Wing loading: 27.96 oz./sq. ft.

Airfoil: symmetrical

Weight: 8 lb., 1.5 oz.

Length: 51 in.

Engine req'd: .60 to .90 2-stroke or .70 to .91 4-stroke

Engine used: Thunder Tiger F-.91S 4-stroke

Prop used: 12x10 W APC*

Radio req'd: 4-channel (throttle, rudder, elevator, aileron)

Radio used: JR 10SX w/NES-4000 servo on rudder; NES-4131s on elevator, ailerons and throttle; JR NEB-480 locater beacon and 1400mAh battery pack.

List price: $339.99

Features: a 90-percent-completed model that includes almost everything you need to fly. You supply the radio, the engine, adhesives and fuel tubing. It is lighter than conventionally built .60-size aircraft, and it includes comprehensive instructions with photos. It also includes stressed-skin composite that's fuelproof, aluminum flying wires for the tail surfaces and a dual-servo aileron setup.

Comments: because this was my first ARF, the high quality of the components and the completeness of the kit made assembly a real pleasure. The kit reminded me of the EZ Sport kits I used to see a few years back, and the finished product is outstanding.

Hits

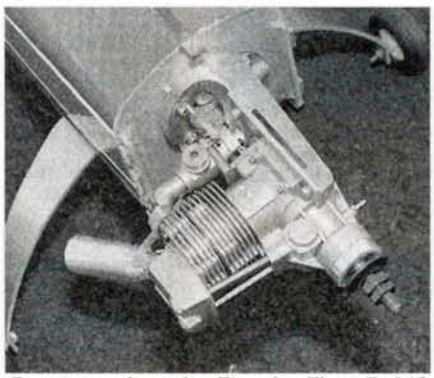
- Ease of assembly.
- Excellent instructions w/good photos.
- Very complete kit.
- Components are of excellent quality.

Misses

- Warped wing-joiner pieces.
- Striping didn't conform well to curves in the cowl and the wheel pants.
- The plastic spinner is too flimsy.

FINAL ASSEMBLY

The cowl is made of four pieces that went together easily. The white striping that hides the seams could have been a little more flexible so that it would conform more easily to the curves in the cowl. In a couple of spots, I had to cut into the striping and remove a small "V" section to get it to lie flat on the cowl's surface. I glued spacers to the triangular cowl-attachment pieces so that they would be flush with the outer skin of the fuselage. If they aren't flush, when you screw the cowl into place, the pressure from the screws deforms the surface a bit. I cut out the hole for the engine and had to cut a slit down the right side of the cowl to get it to slide over the engine. I added another screw and spacer, just above the cut, to hold the cowl in place.



For power, I used a Thunder Tiger F-.91S 4-stroke engine. The aluminum engine mount that comes with the kit has mounting plates for the engine.

My wife, Lucy, got into the act again and did a fine job painting the supplied pilot. When it was dry, I assembled the cockpit, pilot, instrument panel and canopy rather quickly. Be sure to roughen the cockpit surface a bit for better adhesion when you attach the pilot.

It took me about 30 minutes to attach the wheels and wheel pants. The drawing of the bolt that's in the upper left-hand corner of the picture above step 17 shows the wrong size (30mm instead of 40mm). When you apply the striping around the front of the wheel pant, you must be careful because, like the cowl striping, it doesn't conform to curves and the pointed front end of the pant as well as it should.

Before you run the engine, make sure you fuelproof all the exposed wood.

• **Balancing the model.** Mark the recommended balance point and position your receiver, battery pack and switch so that the aircraft will balance perfectly. To achieve the correct balance, I had to place the 1400mAh battery pack aft of the servos. At all costs, avoid adding weight to the aircraft to achieve the proper balance.

I used a JR* NEB-480 locater beacon with my JR 10SX radio. I placed the beacon in the back of the cockpit on the sloped edge and cut a small hole in the cockpit to make it visible. These beacons are great plane savers and I recommend that you use one.

FINALE

There's nothing very difficult or time-consuming about the assembly; it's just that a couple of steps require a little forethought. The instructions state that the plane can be built in about 16 hours. Because this was my first ARF, it took me a little longer. It goes together rather easily and I would recommend it to any first-time ARF builder. It is not, however, a beginner's plane, but it would be the logical next step for Ultrasport-type fliers. They could really get into some twisting aerobatics with this one!

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.*

About the author

Lately, Roger Post Sr. has been spending his flying time enjoying his Great Planes .60-size Piper Cub. When not at the field, he's busy building a new project in his workshop, which sports approximately 13 finished aircraft.

FLIGHT PERFORMANCE

by ROGER POST JR.

Having tuned the Thunder Tiger F-.91S to the atmospheric conditions, we did a taxi test. On our slightly rough field, the wheel pants interfered with the smoothness of the taxiing, so we removed them. After that, the plane handled very well on the ground.*

• Takeoff and landing

When testing a new plane, I always stand behind it during the initial takeoff. This allows me to see the rudder correction needed to counteract left-turning tendencies. The Extra 300 needed a fair amount of right rudder because the Thunder Tiger .91 produced a lot of torque . After a 30-foot ground roll at a throttle setting of less than ½, the Extra was airborne and heading into a nearly vertical climb. I added some down-trim immediately and reduced the throttle to ⅓.

At a comfortable altitude, I throttled back a little more and leveled off by adding some left-aileron trim and a bit more down-trim. During takeoff, I recommend that you advance the throttle gradually rather than "firewalling" it because you could get in over your head if you aren't used to lots of torque and a steep climb-out on takeoff. During later flights, I achieved more comfortable takeoffs by letting the plane fly itself off the runway rather than blasting it off.

Landing the Extra is a dream. Set up a long, flat descent rate by throttle management and re-trimming the elevator. After that, keep it straight and level with the rudder and ailerons, and flare into a three-point landing a few inches from the ground. If your plane dead-sticks, don't worry because it will glide like your favorite glider. All at the field were amazed at its gliding capabilities.

• Low-speed performance

In a headwind, at a high AoA with some right rudder and a low throttle setting, the plane will virtually hover. A power-off stall was a straight-ahead, mushy stall with no evidence of a break. The wings remained level, and the controls were quite responsive throughout.

• High-speed performance

At full throttle, this plane will probably go at between 70 and 80mph. Even at this speed, it didn't seem to be too much for an average sport flier to handle. To achieve a power-on stall, reduce throttle. A nice easy break results, but if you don't hold in some right rudder to keep the plane straight during the high AoA, it will fall off to the left. If you punch the throttle, pull back on the stick and add right rudder to keep the plane straight, its vertical performance will amaze you. If you have a low cloud ceiling, the Extra could disappear in seconds.

• Aerobatics

This plane is extremely smooth on the controls. The recommended high-rate throws allow it to do any maneuver in the book. Lomcevaks, flat spins, inverted flat spins, snap-rolls and all other violent tumbling maneuvers just seem to flow out of the Extra's performance capabilities. With the right wing down and left rudder added, knife-edge flight required some right aileron and up-elevator to remain on a straight track. Loops and stall-turn maneuvers were easily accomplished, but the left axial roll went out of line. I removed some of the down-aileron on the right side and the problem was corrected.

This is a great flying plane, and anyone from a novice on up could fly it; just keep that takeoff under control.

Jim Ryan with his electric Lightning—an easy-to-build, reliable flier that sounds great in the air.

P-38 Lightning

by JIM RYAN

An easy-to-build, sport-scale electric twin

ONE DAY, I was at the field having more than a little fun with my Adler Speed 400 motor glider, and I got to thinking how easy a simple electric twin would be to build. After landing the Adler, I realized that its fuselage looked like the long, slender tail booms of a P-38 Lightning. That's it! All I needed to do was build two simple nacelles, a center pod and a wing, and I'd have a small twin-engine warbird. With film covering, it could be ready to fly in two or three weekends.

With my customary abandon, I raced home and drew up the plans that evening. Designing a model of this type is a compromise between several factors. Available power from the Speed 400 ferrite motors is limited, so I needed a small airframe, but I wanted a low wing loading for easy hand-launching and slow landing speeds. Based on the available power, I established a weight target of 42 ounces, ready to fly. I chose a wingspan of 50 inches, and by cheating a little on the taper ratio, I came up with 340 square inches of wing area. At the target weight, this gave me a very attractive wing loading of under 18 ounces per square foot.

I participate regularly in the electric flight section of Modelnet on CompuServe, and I wasted no time in quizzing the other members about my planned project. As luck would have it, Hannes Delago in Germany had a friend who built a P-38 of almost exactly the size I was planning. He recommended two 7.2V Speed 400s running in parallel on 10, 1000 SCR cells. This would just fit in my weight budget, so the next day, I ordered the motors, cells and an AstroFlight* 210 digital electronic speed control from Kirk Massey at New Creations*. The next evening, I started to build.

The construction went quickly, and I soon had a bare airframe weighing just 9.5 ounces—well under my target weight. Happily, I started to cover the model with film, but at this point, things ground to a halt. I was very displeased

SPECIFICATIONS

Model: P-38 Speed 400

Type: 1/12-scale electric twin

Wingspan: 50 in.

Wing area: 340 sq. in. (2.36 sq. ft.)

Weight as flown: 39 oz.

Wing loading: 16.5 oz./sq. ft.

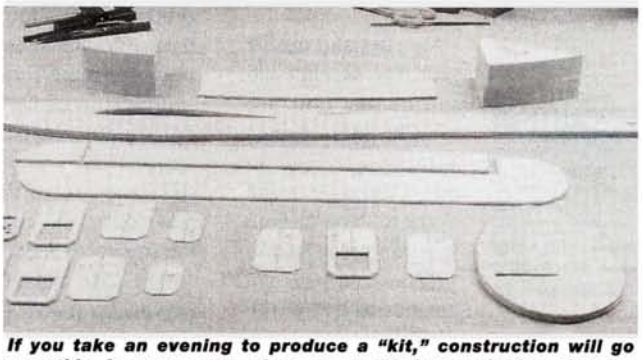
Length: 36 in.

Radio req'd: 3-channel (speed control, elevator and aileron)

Power: two 7.2V Graupner Speed 400 motors, 16 Sanyo 600AE Ni-Cds, Astro-Flight 210 speed control.

Features: Eppler 205 airfoil, foam-core wing, simple balsa construction.

Comments: the P-38 has a simple, straightforward structure. If the builder uses reasonable care in selecting wood and resists the temptation to beef it up, the weight target is easily attainable. Owing to its light wing loading, the model is a gentle and stable flier and within the abilities of any competent sport pilot.



If you take an evening to produce a "kit," construction will go smoothly. As you can see, the part count is low, and this makes it a quick project.

with the way the shiny aluminum covering looked, and I laid the project aside for a week or two to regroup. After careful consideration, I decided to see how light a job I could make of glassing and painting the model. By using thinned finishing epoxy, .56-ounce cloth, a light coat of primer and Krylon "dull aluminum" paint, I kept the finished airframe weight to 13.5 ounces, making the total weight of the glass, wing fillets and paint just 4 ounces.

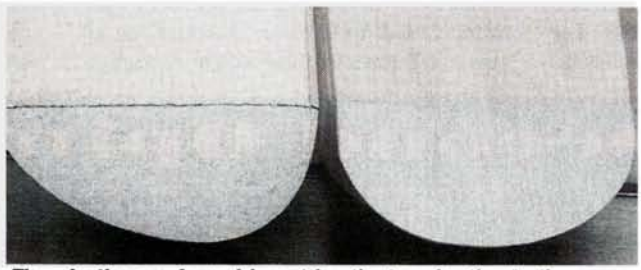
I still wasn't out of the woods, and I found the hardware installation a bit difficult because I had made only one conduit in the wing for the motor wires and servo wires. I've changed this on the plans to show two of them—one for the motor wiring and one for the radio leads. Also, I found that there was no way to get the model to balance with the 10-cell 1000 SCR pack in front of the wing leading edge, and the cells wouldn't fit under the wing. Luckily, I discovered that an 8-cell 600AE pack would fit under the wing as if I'd planned it that way (I hadn't). With a second 8-cell pack in the main battery compartment, the model would balance perfectly. As a side benefit, the total weight was reduced by nearly 4 ounces. So I rewired the harness to run 16 600AE cells in series (for more information on wiring electric twins, see Keith Shaw's article in the December '91 issue of *Model Airplane News*).

Ready at last for the test flight, the Lightning had a finished weight of just 39 ounces and a wing loading of 16.5 ounces per square foot. I chose Graupner* 6x4 props, which cause the motors to draw about 9 amps at full throttle. The first flight was an absolute joy, and every flight since has been no different.

CONSTRUCTION

Complete construction notes accompany the full-size plans. To keep weight and construction time to a minimum, the structure of the P-38 is as simple as I could make it. The wings are foam with balsa skins, the pod and nacelles are simple balsa boxes, and the empennage is sheet balsa. I'd like to thank my friend John Kauk, who built the second prototype and provided the construction photos for this article.

• **Wing.** The foam-cores are skinned with 1/32-inch balsa. I now use 1/32-inch sheet even on fairly large projects. It's easy to work with, the weight savings over 1/16 inch are significant, and its strength is more than adequate. The cores are cut to an Eppler 205 airfoil (with 2 degrees of washout). If you're not set up to cut your own cores, I can supply a set for $18—6941 Rob Vern Dr., Cincinnati, OH 45239; (513) 729-3323.

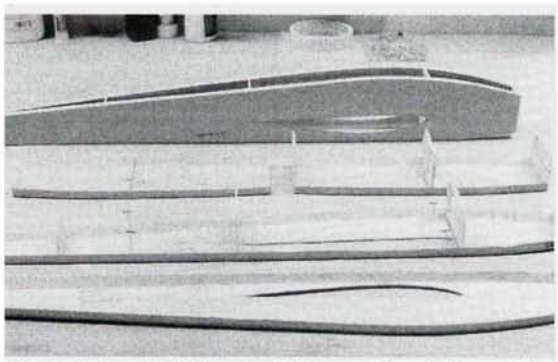


The wingtips are formed by cutting the top sheeting to the proper shape and then beveling the bottom surface of the core. Then the bottom sheeting is attached.

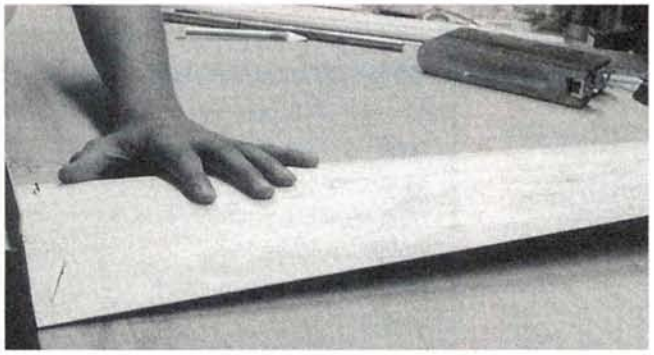
While drawing the plans, I realized that if the wingtips were a sheeted extension of the foam wing-cores, I would save some weight. To do this, I sheeted the top surface of the cores normally, then I cut the wingtip to shape. I then used a sanding block to bevel the bottom of the wingtip until I had a clean, feathered surface up to the top sheeting. Only then did I attach the bottom wing skins. This type of wingtip is very scale for the P-38, is quick and easy to do and weighs next to nothing.

There are several ways to make the wiring conduits. Many builders prefer to rout troughs in the foam-cores before installing the bottom sheeting, but I like to drill the wiring conduits after the wing has been sheeted. Just use a piece of sharpened 3/8-inch brass tube and a variable-speed drill, and carefully bore holes into the cores from the root to the nacelles. Whichever method you use, you need to cut wire exits in the conduits at both the nacelles and the center pod.

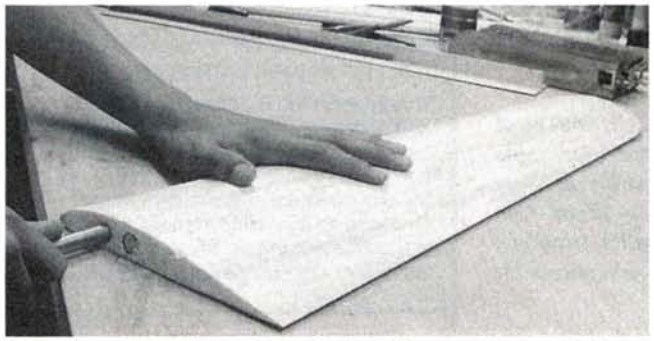
Before you join the two wing panels, place each panel



Here are the partially completed nacelles. Although the sides are thin, the fiberglass doublers described in the text make for a surprisingly robust assembly.



Rather than using a balsa wedge to set the dihedral angle, the wing roots are simply beveled to the correct angle. Because the P-38's planform distributes the load across the wingspan and the joint is reinforced with fiberglass, no dihedral brace is needed.



After the wing has been sheeted, the wiring conduits can be bored with a sharpened piece of 3/8-inch brass tube. Alternatively, you can rout troughs before you sheet the cores.

on your bench with the root at the edge of the bench, block the tip up 2¼ inches, and sand the root to the proper dihedral angle. Join the panels with thick, odorless CA, and then glass the joint with 1.5- or 2-ounce cloth. I like to apply the reinforcement cloth with thin, odorless CA; it makes the job quick and painless. The ailerons are cut directly from the completed wing, and the bare foam is faced with balsa. At this point, the wing is complete.

• **Nacelles and center pod.** The nacelles and the center pod are simple balsa boxes with triangle stock to allow radiuses at the corners. You'll note that the sides of the nacelles and pods are cut out to allow the pieces to slide over the wing. All the sides are 1/16-inch balsa, and ¼-inch triangle stock is CA'd along the edges. You'll need to make relief cuts every ½ inch or so in the triangle stock where there are bends. *Be sure to make left and right nacelles; the inboard and outboard sides are different!*

Before you proceed with assembly, use thin CA to laminate a layer of 1.5- or 2-ounce glass cloth onto the *inside* surface of each nacelle and pod side so that the cloth overlaps the edge of the triangle stock. This glass "doubler" should continue back to about 2 inches behind the TE of the wing cutout. I use these "doublers" on all my small models; their weight is negligible, and they give the structure much greater torsional rigidity and make it more resistant to splitting.

The assembly of the nacelles and the center pod is straightforward. Work with the parts pinned down to ensure straightness. With the formers installed, the tops and bottoms of the boxes are sheeted with cross-grain 1/16-inch balsa, except for the ½-inch strips of 1/16-inch plywood at the front and rear of the hatch opening in the pod. When the boxes are complete, sand the corners to a smooth radius.

The nose and tail cones for the pod are carved from soft balsa. Cut two 1-inch-thick blocks to the nose profile and tack-glue them together. Then tack-glue them onto the end of the pod. After the outside surface has been carved and sanded to shape, pop the blocks off the pod, split the halves apart, and hollow them out before you glue them back together and reattach them as a finished nose cone to the pod. Repeat for the tail cone. I found it easiest to delay cutting out the wing opening until the pod was complete. At this point, lay the pod template over the finished pod, mark the opening, and carefully cut it out by sawing though PF-3.

The tail surfaces are simple 1/8-inch balsa-sheet stock. They should only be dry-assembled until they're covered. At this point, you should dry-fit the airframe together to make sure everything fits properly.

• **Covering.** On a one-piece model such as this, I find it much easier to cover the components before I do the permanent assembly. As noted above, I chose to glass and

A Second Opinion

I built the P-38 from a CAD plan that Jim sent me via CompuServe. It's a clever design, and the low parts count and simple shapes make it easy to put a "kit" of parts together quickly. Proper wood selection is critical to keep the weight within acceptable limits. I made some poor choices, and my plane weighs 4 ounces more than the prototype. A couple of things I really like about the design are the fiberglass doublers and the way the wingtips are constructed.

John Kauk holds his version of the P-38.

The first flight, except for a case of "first twin" nerves, was uneventful. After a good hand-launch by my friend Greg "Cat-Shot" Gimlick, the plane climbed out like a homesick angel. But while the power was more than adequate for level flight, the plane flopped out of loops before getting through the top.

The power system for the first couple of flights was identical to what Jim used, except for the props. I used APC 6.5x5s, trimmed about 1/8 inch. This has worked well for me on the 7.2V motor. At KRC, after seeing Jim's version fly, I switched to the Graupner 6x4, and flight performance is much improved. The plane is faster, with more power for the vertical maneuvers, and it really looks great in the air, especially when it makes those low, fast strafing runs.

FLIGHT PERFORMANCE

• Takeoff and landing

I checked the CG carefully. As my friend Ralph Weaver says, "Nose-heavy planes fly poorly, but tail-heavy planes fly once." This is especially true of smaller models. I was worried about the servo leads and motor wiring running in one bundle, so I was unusually careful about my radio range check. As it turned out, this wasn't a problem.

I was also a bit concerned about the hand-launch. It's ideal to have an assistant who can do the honors, but I've seen too many models thrown into the ground, soft-armed, or thrown straight up into a stall. I chose to be my own assistant. After a final check of the control throws, I started the timer, ran up the motors and threw the P-38 firmly, straight at the horizon; it's important to resist the temptation to lob it upward.

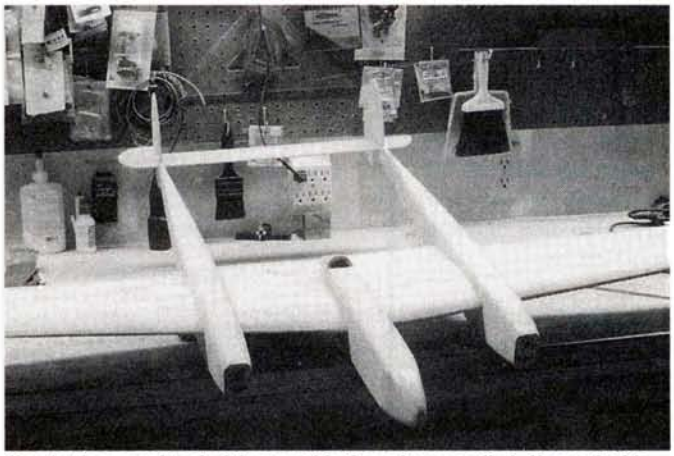
A few brief words on belly landings: I sweated a little in anticipation of the wear and tear of landings, but I needn't have worried. In my 30-plus flights to date, I've misjudged the landing once or twice, and once, a weed I couldn't see snatched the model out of the air when it was about a foot off the ground. This heavy use has proved the airframe is well up to the stresses of day-to-day flying, and you should resist the temptation to beef it up. I remind you that cows don't really fly all that well.

• Flight and stall characteristics

After a firm throw, the model flew straight out and started a gradual climb. I made a turn and came back over the field. Trim was very nearly hands-off. There was very little need for trim change with changes in power, so the zero thrust line I used was a good choice. At altitude, I pulled off power to check the stall. With its clean airframe, the model took a while to slow down, and it was going very slowly before it gently dropped the right wing (the receiver battery makes the model slightly heavier on that side). I did a couple of loops and rolls and then a few low passes before landing early on the first flight. I still had plenty of power, and the cells were only warm.

• Aerobatics

Subsequent flights have been all I could hope for. At full power, loops from level flight are no problem, and rolls are clean and realistic. Immelmanns look really nice with a "downhill" exit. The model shines on a low pass, and it's agile enough to stay in close during the entire flight. Top speed is right around 50mph, which isn't bad for a model of this size. A little judicious throttle management will really extend the duration; just pull off some power when heading downhill, stay between ½ and ¾ throttle for level flight, and pour on the coals only when needed.



Here's the completed airframe with the primer applied. If you decide to paint your Lightning, sand off as much primer as you can.

paint the prototype. If you're not comfortable with this technique or simply don't wish to take the few extra days for priming and painting, you can use the covering film of your choice.

• **Airframe assembly.** After the model has been covered with either fiberglass or film, you can proceed with final assembly. Dry-fit the model pieces together, and lay the assembly out on your building board (it must be on a flat surface). To check for proper alignment, measure from each tail tip to the wing-tips. When you're satisfied with the assembly, run a bead of CA around each joint, and leave the assembly to cure.

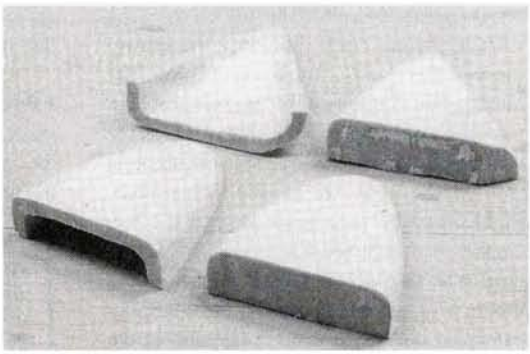
Because I glassed my model, I chose to improve its appearance by making wing fillets around the pod and nacelles with Sig* Epoxolite. My technique is to apply a small bead and wipe away the excess. After 20 to 30 minutes, the Epoxolite is so stiff that I can use a finger dipped in water to mold it to final shape, just like modeling clay. If you take your time on this step, you'll keep wet-sanding to a minimum, and this is a good thing because after it has cured, Epoxolite is as hard as a rock.

You can now prime the airframe and wet-sand it.

• **Final assembly.** When glassing a model, I often leave hinging the surfaces and installing the hardware to the very last; I find it's easiest to wet-sand the primer if there aren't any holes in the fiberglass to admit water. I usually don't care for "easy hinges," but on a model this light, if you cut them in half, they're a pretty good choice. For control horns on these small models, I run ¾-inch 2-56 screws through the control surfaces. A disk of 1/64-inch plywood CA'd in place reinforces the screw hole. On models this size, I use 0.045 music wire for the pushrods, and to install the elevator pushrod, I simply sharpen it and push it through the nacelle side and the formers, using the elevator horn as a guide to get the right line. When the rod is in place, I solder the end fittings on.

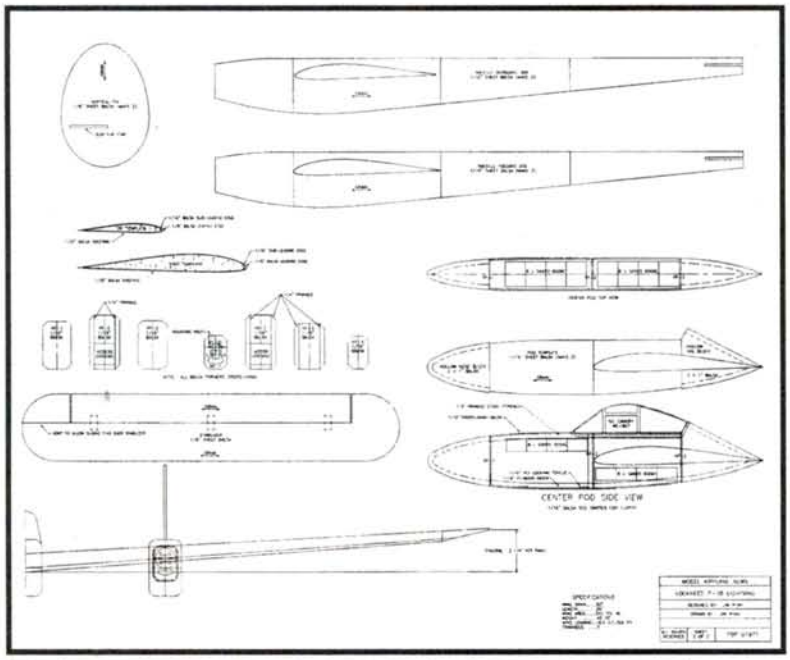
I used a Sig WC-807 7-inch WW II canopy. By trimming the rear of it as shown on the plans, you get a pretty good approximation of a P-38 canopy, and you don't have to carve a vacuum-forming plug.

• **Finish painting.** If you plan to paint the airframe, make sure you use a sandable primer and wet-sand as much of it off as possible. This will make a difference to the finished weight. After you've checked for dings and dents, paint the airframe in the color scheme of your choice. I've discovered that Krylon or Spar-Var (both made by Sherwin-Williams) "dull aluminum" is a godsend for electric fliers. It's light, opaque and easy to spray. Two light coats will give you a very nice, weathered-aluminum finish, and it's also easy to use for

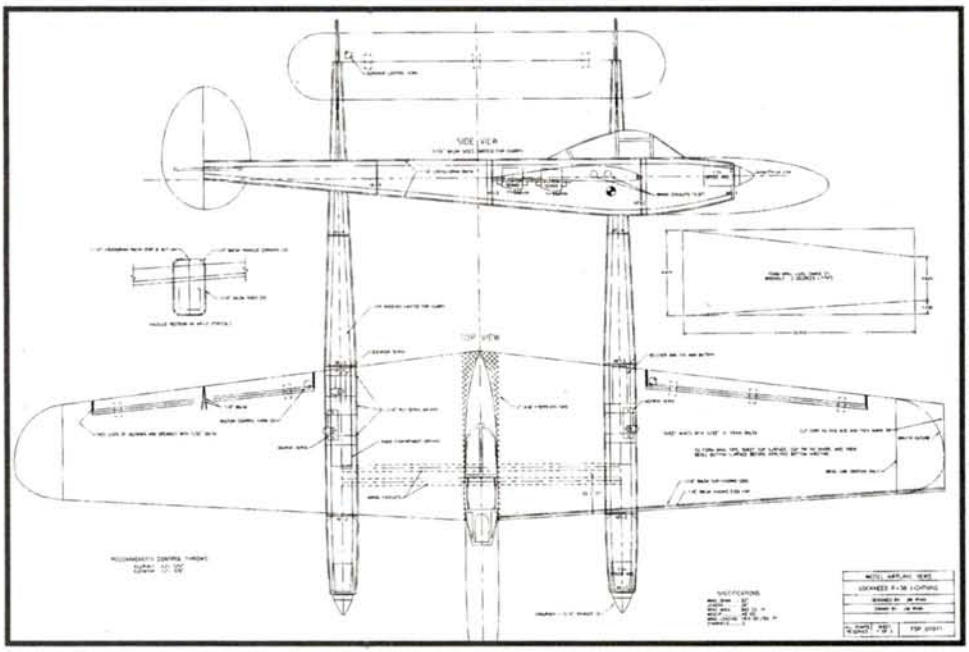


After the nose and tail blocks have been carved to shape, they're taken apart and hollowed out.

touch-up. That it isn't fuel-proof is hardly a problem if your fuel is electrons. I used artist's frisket to mask the canopy and then painted the canopy framing. You can also use chrome trim tape.



• **Radio installation.** Installing the radio in the three small compartments required some forethought. I eventually decided that the receiver and battery should go in the nacelle opposite the elevator servo. This turned out to be a good idea because placing the 1.3-ounce 150mAh receiver battery at the rear of the nacelle's radio compartment was just right to balance the model. I cut the servo openings through the wing and then CA'd 1/16-inch plywood servo mounts into place directly on the wing surface. In my case, threading the wiring through the conduit took some doing, but making two conduits will cure this problem. I used a fish cord to help thread 18-gauge "zip cord" and the servo extensions through as a bundle from one nacelle to the other. Eighteen-gauge wire is adequate at the low current used in Speed 400 models. When the cord was in place, I fished a loop of the motor wire and the tail end of the controller extension out of the conduit opening in the battery compartment. Snip one of the motor wires and solder a Powerpole or Sermos* connector in place. The ailerons are operated by very short pushrods running from the nacelles to each horn. The simplicity of this approach was well worth the weight of an extra microservo, even on a model of this size.



TO ORDER THE FULL-SIZE PLANS (FSP01971), CALL 1-800-537-5874.

• **Powerplant hookup.** By this time, you're ready to trim off the extra wire and hook up the motors. I recommend that you advance the timing on both motors by around 1/8 inch, but do this *after* you have connected the wires and checked for proper rotation. Running the motors with retarded timing is a quick "way" to buy extra motors. The 16-cell pack is made up of two, 8-cell 600AE packs linked together. One pack slips into the space under the wing, and the second goes in the battery compartment as shown on the plans. Both are secured with Velcro®-brand fasteners, and the ESC is stuffed in on top of them. At this point, I was so happy with the plane's looks that I popped for a pair of Graupner aluminum racing spinners. I selected Graupner 6x4 props to turn power into thrust. If you've managed to put it off until now, you can hook everything up, switch on and listen to the "sound of freedom"! Make sure everything is properly secured, and you're ready for the test flight.

With 7.2V motors, performance is solid; 6V motors would improve the top speed with a slight tradeoff in duration. Six-minute flights are no problem with modest power management. If I just fly for endurance, I can get up to 8 minutes, but that's hardly the mission of this type of airplane; it's just too much fun to fly conservatively. I hope your first electric twin is as enjoyable as mine has been.

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.*

FSP01971
P-38 Lightning

The electric P-38 Lightning is a G400-powered sport-scale model that's easy to build and fly. The wings are sheeted foam, and the rest of the aircraft is traditional balsa-and-ply construction. WS: 50 in.; motors: G400; 2 sheets; LD 2. **$12.95**

About the author

Jim Ryan of Cincinnati, OH, is a lifelong aviation enthusiast. He's been flying R/C for eight years, and though he's interested in models of all kinds, his favorites are warbirds. In the year since the initial flight of his first electric model, Jim has produced four successful original designs for electric power and has sold every last bit of glow-flying paraphernalia he'd ever owned.

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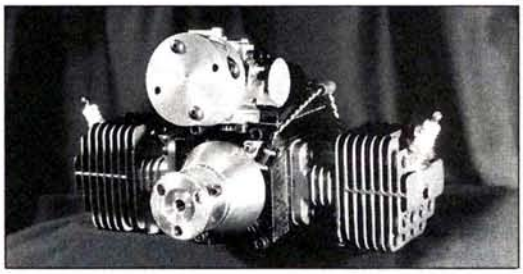

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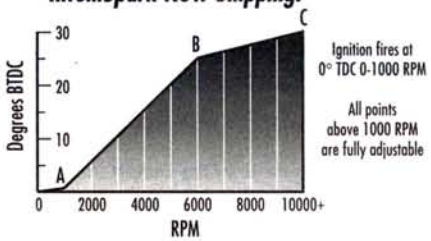

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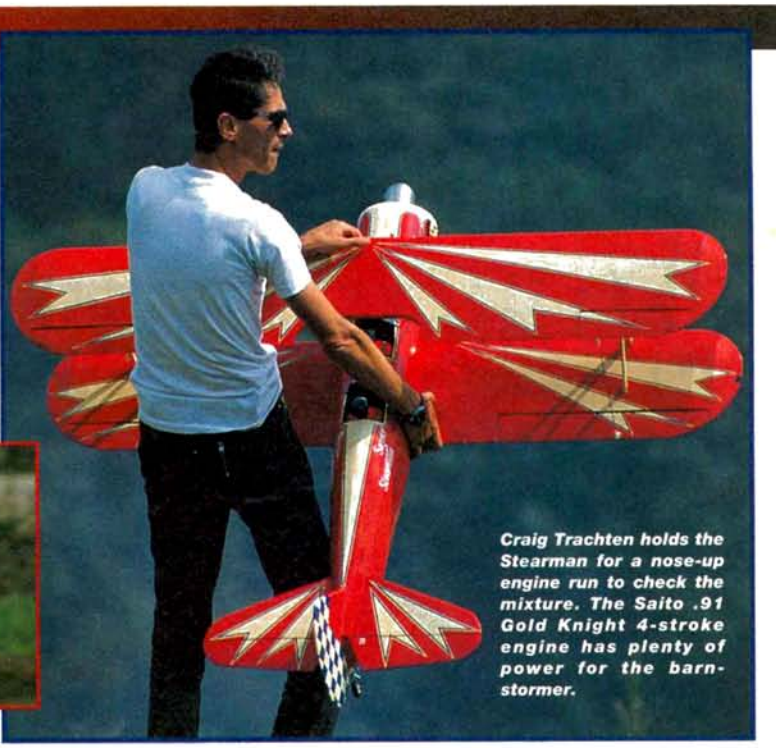
MODEL AIRPLANE NEWS

FIELD & BENCH REVIEW

Classic looks and scale-like performance



Craig Trachten holds the Stearman for a nose-up engine run to check the mixture. The Saito .91 Gold Knight 4-stroke engine has plenty of power for the barnstormer.

PHOTOS BY GERRY YARRISH & WALTER SIDAS

MIDWEST PRODUCTS

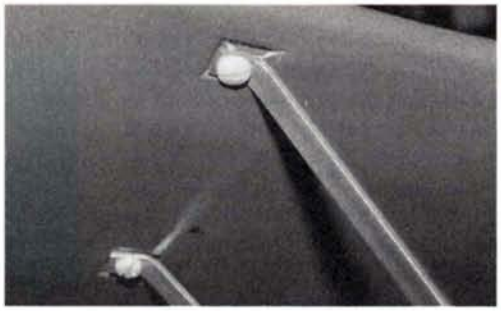
Super Stearman

by VIC OLIVETT

ANYONE WHO has ever been interested in aviation will recognize the Stearman. This legendary big biplane—with its rumbling, fire-breathing, smoke-billowing radial—can still be seen in the sky today. Thousands were built for use as primary trainers before and during WW II. The Midwest* Super Stearman was modeled on Bob Barden's airshow Stearman. Bob's Super Stearman is a vintage 1941 Boeing Stearman with a 450hp engine.

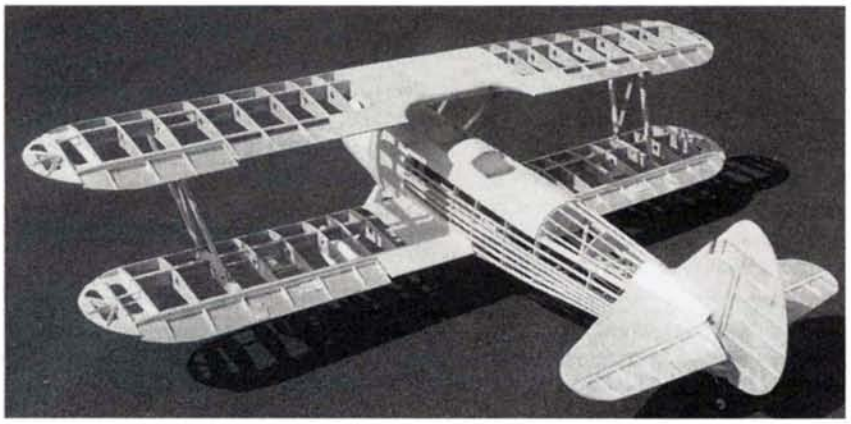
THE KIT

The first impression you get when you open the box is of a high-quality product. The kit is very well packed, and the wood is top grade. The very extensive hardware package supplies just about every thing you'll need. The full-size plans are well-done, and the 50-page instruction manual will take you through the construction step-by-step; but remember: read, read and read it again.



Simplifying the cabane strut design is the use of formed aluminum pieces that can be easily bolted into position. Nylon bolts are used to attach the top wing to the cabanes.

• **Stabilizer.** The stab is built-up with die-cut balsa and stringers; its trailing edge (TE) has been beefed up with a 1/4x3/8x17 1/2-inch spruce doubler.



The bare bones of the Stearman are almost too pretty to cover. The design is rugged and relatively quick to build.

Because it's difficult to cut hinges in spruce, this is a good time to mark and cut the slots for them. I joined the 1/16-inch sheets with Pacer Technologies* thin Zap CA, then sanded the outer surface. The elevators are constructed of die-cut balsa sheet; then TEs and leading edges (LEs) are added. The ribs are cut from 1/8x1/8-inch balsa and then block-sanded to taper the TE. Be sure to round off the LE of the elevators. The fin is of the same type of construction; cut the rear post as shown on the plans; it will lock into the stab later. Build the rudder using the same construction as the elevators. Mark and drill the holes for the elevator and rudder horns.

• **Fuselage.** The Super Stearman fuselage is built with interlocking, die-cut parts that self-align during construction, so it's important to follow the construction sequence. Build the fuse's lower section upside-down over the top view on the plans, then lift it to install the cabane struts and turtle decks.

Once the front and rear crutch, the master stringers and the keel are ready, the rest of the fuse is easy to build. The firewall is laminated using Pacer's 30-minute Z-Poxy. The plans show the correct position of the thrust lines. The formers snap into place and are then glued using Zap CA+, which allows you a few seconds for minor adjustments. Once the master stringers and keel are in place, the fuse starts to take shape. Follow with the balsa stringers and balsa sheet. The locations are marked for the 6-32 cabane blind nuts. I used Zap CA+ on the flat part of the blind nut and drew in the nuts with a 6-32 capscrew and a large, flat washer. This worked much better than trying to tap them in place from inside the fuselage. The same procedure was used for the landing-gear blind nuts.

Inside the fuselage, the servos are attached to hardwood rails. Two of the four wing hold-down blocks for the bottom wing are shown.

The tailwheel is a good, solid system that should be trouble-free if you install it correctly and carefully. The blocks on both sides of the keel require some shaping and sanding. On the top of the fuse, formers 14 and 16 are slightly slanted to the rear, for the rear of the cockpits. The stabilizer platform is 1/4x3 3/32x6 5/8-inch balsa that must be tapered from 1/4 to 1/8 inch. I taped a 1/4- and a 1/8-inch drill bit to the workbench. With the balsa block between the two drill bits, the sanding block uses the bits as a guide. This is very important because it sets the angle of the stab. Bolt the cabanes in place, and use the Zap CA+ to secure the bolts. Finish the

SPECIFICATIONS

Model: 1/6-scale Super Stearman

Type: sport scale

Manufacturer: Midwest Products Co. Inc.

Wingspan: 65 in.

Wing area: 1259 sq. in.

Weight: 12 lb. (with 30 oz. of lead for balance)

Wing loading: 22 oz./sq. ft.

Engine req'd: .60 to .75 2-stroke, .80 to .91 4-stroke

Engine used: Saito FA .91 4-stroke

No. of channels req'd: 4 (throttle, rudder, elevator, aileron)

Prop used: 14x6 APC

List price: $299.95

Features: all balsa and plywood construction; complete hardware package.

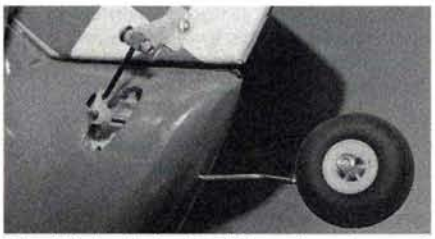
Comments: the Midwest Super Stearman is one of the most enjoyable kits I have ever built. Everything fits, and the plans and instructions are very well done.

Hits
- Excellent plans and instruction manual.
- Top-quality wood and hardware.
- Easy to build.
- Excellent flight characteristics.

Misses
- Large amount of nose weight required to balance properly. (Midwest notes this in its building instructions.)

fuselage as indicated on the plans. I used a Saito* .91 4-stroke as suggested on the plans. Installation of the engine and fuel tank are straightforward; again, follow the plans.

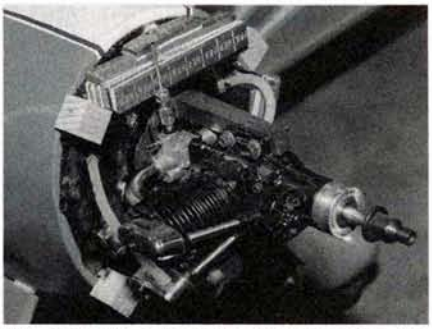
• **Wing.** Build the Stearman's wing panels directly on the plan, using it as a pattern to position the parts. Join the panels after you've built them. The manual has multiple sets of check-off boxes in this section. Use one set of boxes while you build the top wing, and the rest while you work on the bottom wing. The bottom wing is set up for two servos; this works well because each servo controls two ailerons—one each on the top and the bottom wing. The hardwood blocks in the top wing are very important. They will be drilled and tapped for the 1/8-inch cabane struts. Zap CA+ with "kicker" works well for this step. I also used Zap CA+ to attach the preshaped TEs. The ailerons are die-cut and have hardwood blocks inserted for the control horns. These follow the contour of the ribs and are later covered. Cut out the ailerons after the wings have been framed. Once the wings have been joined, shaped and sanded, they can be drilled and tapped for the hold-down screws. Take great care; wing alignment is very important. Try to make them as perfect as possible. Rather than glue the "N" struts, I drilled the joints and pinned them with 1/8-inch dowels. For a strong joint, apply a drop of thick Zap before you drive in the pin.



The tailwheel steering linkage is unique and works very well. Balsa blocks are used to shape the fuselage where it is faired into the rudder.

FINISHING

The landing gear is wrapped with balsa and sanded to shape. I used Zap-A-Dap-A-Goo for this step and allowed it to dry overnight. Although getting wood and aluminum to bond can be a problem, I have found this method to work very well. After I joined and sanded the wheel pants, I applied 21st Century* primer and sanded the pants smooth before painting. I used 21st Century red, cream and dark blue fabric to cover the Super Stearman and finished with 21st Century paint. With the engine installed and



The Saito .91 Gold Knight is attached to the firewall with a plastic engine mount. Installation is simple. Note the lead weight used to achieve the proper CG.

18 ounces of lead weight added to the nose, the Stearman still fell to the tail. An additional 12 ounces were needed to attain the correct CG.

SUMMARY

The Midwest Super Stearman is one of the most enjoyable kits I have ever built. Everything fits, and the plans and instructions are very well done. So if you want to step back in time and feel a rush, make this one your next kit.

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.*

FLIGHT PERFORMANCE

by ROGER POST JR.

For it to be correctly balanced, this plane needed 30 ounces of lead weight, attached to the firewall. I used the prop (14x6 APC) that Mike McConville recommends in the manual; when combined with the Saito .91, there was plenty of power to fly the plane.

• Takeoff and landing

With the torque that the Saito .91 puts out, you'll need sufficient right rudder to keep the plane straight on takeoff. Be sure that your plane's rudder has enough deflection to compensate for the tendency to turn left. The Stearman used about 100 feet of runway before it lifted off, and the throttle setting was at about half. I found the elevator and the ailerons to be particularly sensitive, so unless your thumb is extremely sensitive to control inputs, I recommend that you use the suggested elevator and aileron throws and that you dial in some exponential. When the plane reached a comfortable altitude, I throttled back and checked the hands-off stability. To maintain straight and level flight, the Stearman needed only some down-elevator trim.

Landing the Stearman is fairly basic; line it up with the runway, manage the descent rate with the throttle and flare into a 3-point landing just past the runway's threshhold. I had a couple of dead-stick landings with the Stearman, and I found that this nearly 12-pound plane glides well. To slow the plane's unpowered descent rate, I had to add some up-trim.

The field setup of the Stearman is fast for a biplane. Here, Roger Post Jr. attaches the interplane strut.

• Low-speed performance

The Stearman flies extremely well in the slow-flight mode. Just keep the proper angle of attack and the right power setting, and it will stay there until it runs out of fuel. You'll have to add some right rudder; otherwise, the plane will just keep turning left. The power-off stall just mushed ahead with no sign of dropping a wing.

• High-speed performance

The Stearman will move fairly fast, but it's not a rocket ship. The manual recommends that you fly it in a scale-like manner, and that's what I tried to do. As with most biplanes, to avoid flutter, don't execute full-throttle, high-speed dives. The power-on stall has a well-defined break but doesn't result in sharp drop of the plane's nose. The wings remained level throughout this stall.

• Aerobatics

Once I limited the elevator throw and dialed in some exponential, the plane performed nice, round loops. For tracking during the loop, you'll need to use some right rudder. With four ailerons, the roll rate can be pretty fast. I toned down the aileron throw a bit and achieved a more scale-like roll.

The rudder provided enough clout to perform wingovers, stall turns and hammerheads and had more than enough authority to spin the plane. Turning the plane with the rudder was interesting: right-rudder input turned the plane as expected, but left-rudder input severely pitched the plane down. When I attempted a right-wing-down, left-rudder knife-edge, the same thing happened. To keep the plane in knife-edge flight required up-elevator and right aileron.

Inverted flight required a small amount of forward stick and the correct power setting. All inverted maneuvers were easy to perform; the outside loop needed some rudder input for tracking correction.

by HAL deBOLT

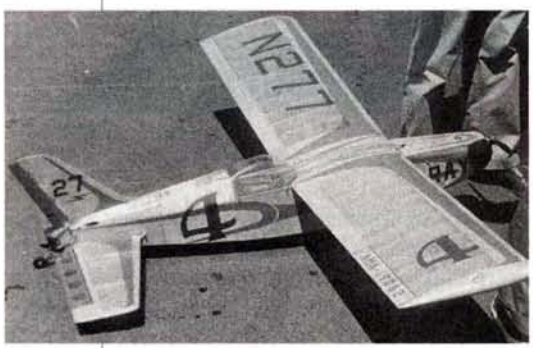
EARLY PYLON RACING

A former AMA president Keith Storey and his Nats-winning AMA pylon racer; see its Wittman Buster appearance?

OUR discussion of the development of R/C flight is well under way, but I've neglected one major aspect—pylon racing. I've discussed Clinton DeSoto, Chet Lanzo and the Good brothers and how the hobby progressed, but pylon racing is an area in which I'm lacking. I need photos, sketches and any and all info you may have to share. I'll start with what I have, and perhaps readers will add to it; I'd appreciate any information on the topic.

PYLON PROGRESS

Early competition involved little more than showing you had control. Just to illustrate this point: Chet



Active in all phases of R/C, Lou Andrews came up with this version of an AMA pylon racer.

Lanzo says his winning flight at the Nats consisted of a couple of turns and an airborne time of 1½ minutes! Then when a number of R/C'ers had learned how to do this, some sort of judging pattern was needed. The "precision pattern" requirements consisted of takeoff, straight flight out, a precision turn, straight flight back, overhead figure-8, landing pattern and a spot landing. Soon, simple maneuvers were added, but they quickly seemed so mundane that a completely new aerobatic pattern was formulated. The point to remember is that competitive aerobatics started almost at the inception of R/C flight.

We humans seem to love a competition, and R/C pylon racing (in several categories) is one of the most exciting types.

It is interesting that when R/C was seen to be viable and precision pattern made an appearance, the urge for speed competitions was also seen. It started unofficially with "speed traps" set up at various meets; we flew through the "trap" with whatever we had—exciting and enjoyable. We loved learning just how fast our models could fly. The interest shown by modelers inspired the AMA to set up a committee to look into establishing an official pylon race.

The first rules were relatively simple and took into consideration the type, size and related power of R/C models then *in general use*. It was first agreed that the largest allowable engine should be the .20ci; then a related wing area was specified: .15 to .20 engines had to have at least 760 square inches. To encompass all models, there were two other classes: engines up to .10 required at least 386 square inches and those up to .15 required 576 square inches. There were no other restrictions.

PYLON PROCEDURES

The course had two pylons set 528 feet (1/10 mile) apart, and a flight was five laps around them (one mile). The first events were speed trials rather than races. Competition was against the clock—not pilot against pilot.

A flight began with a takeoff or hand-launch at the start/finish line, at 90 degrees to the first pylon, and the flight was timed from then until the model crossed the finish line. The shortest recorded time won and so on. Unlike in today's events, if you cut a pylon, you were required to circle it and then continue the course. Of course, if you cut a pylon now, you must fly an extra lap, and two cuts mean disqualification.

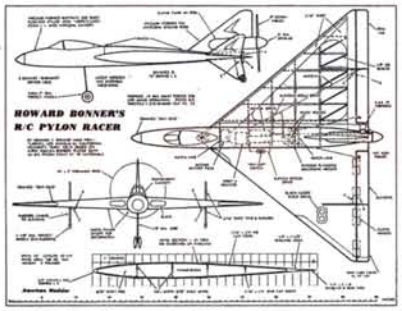
As with the precision phase at these early pylon events, modelers flew whatever they had, so we enjoyed a wide variety of models. For example, at one Nats, Howard Bonner replaced the .35 in his "pattern" Astro Hog with a .19 and did respectfully well in pylon! But we soon saw the appearance of specialized designs; for example, Walt Good's and Bill Herschberger's (DC/RC club) pylon racers would look good against today's Quickie 500-style racers. Bill went on to become quite a master of the event!

Time passed, and renowned R/C'ers got serious about the event and showed up with more exotic designs. Keith Storey's Nats winner and Lou Andrews' entry show a trend

Early on, the Flying Bisons envisioned pylon racing with rudder only. With this '50s design, deBolt investigated the possibilities.

to a more scale-like appearance.

The AMA's pylon event rapidly became popular, both at the Nats and at most of the other major R/C meets. Sport pylon—a spinoff—was soon evident at



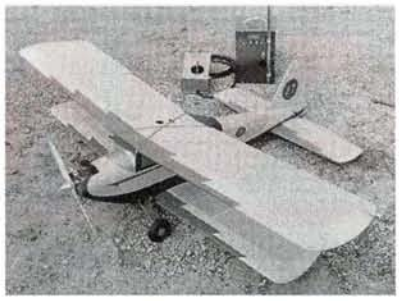
Walt Good's early AMA pylon racer. You thought Walt only flew Guffs and Rudder Bugs?

major meets, too. The rules for this were almost the same as those for AMA pylon, but there was no restriction on model or engine size. R/C'ers regarded this unofficial event as fun time, and they flew sport or pattern models. For many, it was a welcome diversion from regimented pattern competition.

Pylon racing started when we had only two frequencies—27.255 and the "ham band," and we couldn't fly more than one plane at a time. When the FCC at last gave us five spots on the 27MHz band, racing became a possibility; but for that, the AMA needed different rules.

Visionary modeler Jerry Nelson—the "godfather" of Formula One—attended a *full-scale* "Goodyear" pylon race and was inspired by the sight of several racers rounding the pylons together. Filled with enthusiasm, Jerry built what he thought would be a viable, scale-like R/C pylon racer—a Wittman Buster, I think. Following its success, Jerry quickly came up with several other scale-like designs, and he soon had several buddies flying his pylon creations.

With that, the stage had been set to test the practicality of holding multi-plane races. With Jerry's guidance, the California-based First All Speed Team



DeBolt's AMA pylon bipe was a smaller package that used two wings to meet the area requirement.

Club put together rules for this and held several trial races in the area; the rules appeared to be usable and sufficient.

Because multi-plane racing was obviously a possibility, the rules were firmed up and submitted to the AMA Rules Committee—Howard Bonner, Howard McEntee and me. From this committee came the AMA Goodyear pylon-racing category.

Please tune in next time; there is so much more!

MULTI-CONTROL DEVELOPMENT

Model aviation has grown because of its organizations—local clubs. On the East Coast, major boosters were the DC/RC, the Pittsburgh Flying Circuits and the Flying Bisons. Out West, the San Francisco Mustangs and the L.A. Radio Kontrol Society (LARKS) were the movers and shakers. The members of these clubs heightened the awareness of R/C throughout the nation.

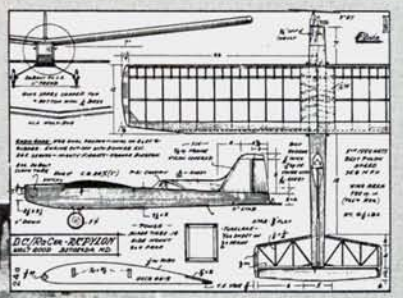
Ray Downs and Howard Bonner were among those who established the LARKS, and they were always prominent members. Howard became interested in R/C in the very early days, when it seemed as if everything we used could stand a lot of improvement. Like the relays, the first escapements were "Rube Goldberg" in nature. Many of their shortcomings arose from the crude fabrication of their parts; better-made parts would be a great step forward.

A young Howard Bonner at the '51 Nats with his single-channel design that evolved into the famous Smog Hog. Note the C-S 465 transmitter.

Howard was an accomplished tool-maker with considerable perception. Realizing our need, he organized Bonner Specialties and produced trouble-free escapements—real jewels!—in enough varieties to meet every need. With the "compound" version, multi-controls became practical. I still vividly recall the first time I punched a compound escapement three times and was amazed to see the true loop that resulted!

Howard was always an active R/C competitor who won both pattern and pylon events. Flying a compound-escapement-equipped Trixter Beam, he once scored respectably well in the Multi class!

When reed systems came on the scene, Bonner Specialties was the major supplier of the needed servos. They offered a variety of models and modifications that climaxed with the Digimite for relay-less reeds.



This AMA pylon design is a good example of Bonner's vision, and its looks rival those of today's jet fighters!

Howard's most ambitious project by far was to conceive, develop and manufacture the first major commercial digital-proportional R/C system. He brought in people who were then on the leading edge of digital—Mathes, Elliott and Weirick, etc.

Howard even handled the precise packaging neatly; in fact, his penchant for perfection in all details led to the development of a complex, elaborate system. That it worked well was demonstrated by the nearly perfect flight with which Cliff Weirick won the Nats.

And where is Howard Bonner today?—in retirement, no longer active in R/C, it is said. I wonder whether any of you are in touch with him?

FAI World Scale CHAMPIONSHIPS

This little-known French Caudron G-3 was entered by Vladimir Handlik (Czech Republic). Model won 1994 World Scale FAI in F4C; 2nd in '96; completely scratch-built; 1/5.3 scale; wingspan—3.51m; JAP 20 engine. Constructed from original aircraft drawings; operational wing-warping cables from the fuselage to the top wing; linen finish matches prototype aircraft in Le Bourget Airport Museum (Paris).

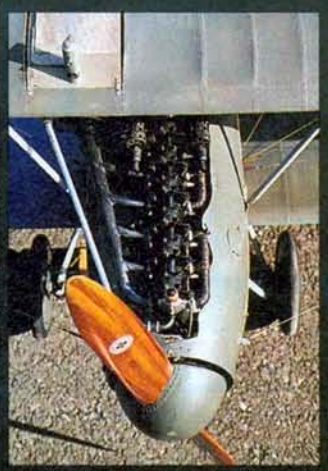
A SCALE world championships is quite an experience—especially for someone who attends for the first time. Traveling to Europe and learning your way around a new country—in this case, France—are very exciting.

Andreas Luthi's Nieuport 28 was modeled after the prototype in the Swiss Air Museum; 3rd in F4C. Fewer than 30 points separated 2nd and 3rd; 1/4 scale; completely scratch-built; Laser 1.2 4-stroke.

Périgueux is a town in southern France—a region of fertile valleys and rolling hills. The natural scenic beauty of the area, combined with the historical landmarks, makes it a great vacation spot. Modelers from more than 22 countries arrived there to be a part of the 1996 World FAI Scale Aeromodeling Championships, held at the Périgueux-Bassillac Airport, where the full-scale runway provided ample room for these scale masterpieces, and the large wheat fields were a great over-fly area. This was especially fitting because of the many WW I aircraft entered.

FAI scale competition is like the Olympics. The championships is held every two years. In 1994, it was held in Arnhem, the Netherlands; in 1996, at Périgueux; and in 1998, this most prestigious of scale championships will land in South Africa. Countries submit bids to host the event in much the same way as they do to hold the Olympics.

This model is of Baron Von Richthofen's plane; Max Merckenschlager's beautiful Albatros DVa took 2nd in 1994 World Championships; 1st place in '96 F4C—by only 46.66 points more than 1994 winner, Vladimir Handik, flying the Caudron G3. Note the plywood finish on the fuselage—not simulated, but a very thin plywood veneer that covers the fuselage sides (much like the original); only the metal part of fuselage is painted.



It took Max about 2,000 hours to build the 1917 Albatros from documentation obtained at the Australian War Memorial Museum at Kender. To cool the engine, air enters behind the spinner and exits through the open area around the scratch-built dummy engine; Laser 30cc 4-stroke from England (available from Proctor Enterprises); wingspan—2m; took over a year to research the documentation.*

Sopwith Pup entered by South African Humphrey le Grice—one of two entered in F4C; both built from Mick Reeves plans; 14th place; wingspan—79½ in.; just under 7kg.

R/C aircraft Olympics from France

by STAN ALEXANDER

Heinkel He-III bombers were the main attack force in the Battle of Britain. This example was built by Alfonso Garcia of the Spanish team. Documentation came from the Aviation Museum in Oslo, Norway. The bomber is powered by two Enya .53s.

Jumbo Lockheed C-130, seen here in the pits; wingspan—6.50m; 65kg. The crowds were very impressed.

Only the best modelers from each country attend. To decide who makes the three-person team for each F4B (control line) and F4C (R/C) event, there are regional qualifiers and a national finals. That's also usually where the team manager is selected.

TEAM USA

The U.S. qualifier is held the summer before the actual event; in '95, it was at the AMA's national flying site. Kim Foster, Ramon Torres and Wayne Frederick qualified for the F4C team, and Steve Ashby, Dale Campbell and Jack Sheeks qualified for the F4B team. John Guenther was elected team manager, and Darlene Frederick and Kathy Burnstine chair the committee that generates funds for our team.

To make it happen, the team needs sponsors, and the '96 USA FAI Team thanked Pacer Technology, Futaba, JR Remote Control, Frank Tiano Enterprises and Air France. Team lapel pins and T-shirts were also sold (Wayne and Darlene Frederick designed the team logo).

At a world championships, there are two types of competition: team and individual. In '96, there was also a provisional event—F4CL Large Scale—equivalent to the U.S. giant scale, in which the allowable weight is 25kg and the maximum engine is 100cc. Until the end of the year, the F4C weight limits were 7kg and for electric-powered models, 7.5kg.

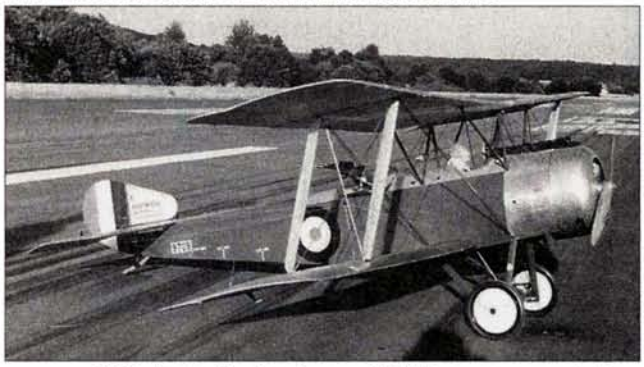
High static score was earned by Czech Republic's Pavel Fencl with his Knoller CII; scratch-built to scale of 1/4.3; functional control cables like those on full-scale aircraft; inside cockpit is an operational joystick; functional airspeed indicator on outboard right strut; wingspan—2m; O.S. 1.20 4-stroke.

BEING THERE

Even before the competition started, we realized that, as Dorothy said, "We aren't in Kansas anymore." On Saturday afternoon, everyone associated with the championships participated in the opening parade through the streets of Périgueux to the town square, where the mayor welcomed us. At Sunday's opening ceremony, all the teams unfurled their flags and raised them to their national anthems. Last to appear was the FAI flag.

Unlike U.S. scale contests, FAI scale runs at a slower pace. After the opening ceremony, static judging and timed-flight competition began. Pilots were assigned times to have their planes' static judged; it takes three to four days to complete this process. Only one aircraft from each class is flown at a time; this minimizes distractions and the risk of midairs (remember, most of these are museum-quality planes!).

Off the flightline, lunches and dinners were catered affairs. Wine from local vineyards was the drink of choice, and meals were prepared by the Périgueux Aero Modelers (the host club), who are gourmet cooks by profession. The club also provided guided tours of the region.



F4CL Large Scale winner, Mick Reeves; own design, scratch-built Sopwith 1½ Strutter; ⅓ scale; wingspan—120 in.; 33 lb.; covered with Solartex fabric in a linen color; HobbyPoxy paints. The 1½ Strutter entered service in the RGC in the spring of 1916. It was the first British aircraft to use a synchronized Vickers machine gun and a rear-mounted Scarff ring for a Lewis gun.

Almost all of the models feature scale construction throughout. Details include rigging and control cables, tires, wire wheels, complete cockpits, dummy engines, propellers and even airspeed indicators! Many would say, "Well, that is pretty easy to accomplish in this day and age; you can buy just about anything you need to build a model." This is just the point. These craftsmen build almost all or all of their parts from scratch.

Ando Yoshitaka scratch-built his Kawasaki Ki 100, including landing gear and retract mechanisms. For documentation, Ando included a variety of photos and found the designer of the full-scale fighter (he is now 92 years old).

The airport's main hangar served as the pit area for the contestants, and national flags added to the event's international flavor. Static judges worked at the large hangar's door, and each team had a pit area. The U.S. team was between Japan's and Sweden's teams.

Pilots weren't allowed to see their static scores until after the static judging had been completed. In F4C, the highest static score was earned by Pavel Fencl with his beautifully hand-crafted Knoller C II. This aircraft, along with many at the contest, had been scratch-built; to an FAI competitor, this means he drew his own plans and cut, machined, or manufactured his own parts; some modelers even carved their own props. Talk about attention to detail! In the F4B class, Marion Kazirod, competing with his 1994 World Championships winner—an Avro Lancaster B Mk I—took the top static score. Marion went on to win the world championships for the second time in a row, combining his high static score with an impressive set of flight scores.

The members of our team, all decked out in red, white and blue uniforms, really worked together and finished third in the F4B class and fourth overall in the highly contested F4C class. The provisional F4C Large Scale event was not officially sponsored in the U.S.; because of this and the fact that several potential competitors crashed, our team did not compete in it.

Notice the large number of biplanes—mostly WW I fighters and bombers—in the standings for the '96 championships. The reason is the "complexity bonus." As stated in the FAI's general regulations and special rules, "... to compensate radio-controlled models of complex prototypes for their inherent disadvantages in flight, ... bonuses shall be awarded in the form of a percentage of the total flight score with a maximum accumulation of 15 percent."

So if you have a biplane with scale undercambered airfoil section (5 percent), and the aircraft is a twin (6 percent), with a tailskid (3 percent) — you'll receive a 14-percent complexity bonus to your flight score; a trike-gear monoplane is entitled to a zero bonus. (This is in F4C only; in the control-line class, F4B, you'll see a completely different approach to the type of aircraft used. Mechanical options seem to be the ticket to having a winning aircraft in this class.)

LARGE SCALE

At its first world championships, F4CL Large Scale had a good turnout. With 17 contestants, Mick Reeves won with his larger ⅓-scale Sopwith 1½ Strutter. Mick Reeves' designs are available from Bob Holman Plans*. Kit designer Duncan Hutson flew his own design Tiger Moth to second place, and another Tiger Moth—from Italian Marco Inga—finished third. Other than a Yak 3 and the P-61 Black Widow, there wasn't any "heavy metal" entered in this class.

There were many interesting and unique models in all three classes; many of them you won't see in the U.S. in scale competition: Mick Reeves' Sopwith 1½ Strutter WW I biplane, the Caproni Ca-100 by Piero Santucci, the Handley Page Heyford by Kurt Lenna from Sweden, the Antonov AN-14 by Vasiliy Kromin from Austria, and the Demoiselle by Antoine Zimberlin of France.

Having the top static score in any

Left: Ramon Torres and his Beechcraft T-42; highest U.S team member in F4C; 8th overall; brand-new model; wingspan—91 in.; 6.9kg; Enya .53 4-strokes. The epoxy-glass fuselage has a honeycomb construction; the wings and flying surfaces are built-up balsa and plywood; K&B epoxy paints, custom-mixed by Ramon. Right: F4C Individual awards: 1996 World Champion Max Merckenschlager; 1994 Champion Vladimir Handlik (Czech Republic)—2nd; Andreas Luthi (Switzerland)—3rd.

scale competition is always advantageous when the final scores are posted. This year in the F4B class, former world champion Marion Kazirod of Poland took the top static spot with a score of 1,831.50 points and went on to win the control-line event with his Avro Lancaster B Mk 1 bomber. The multi-engine bomber had flaps and bomb drop as mechanical options. Six of the top 10 finishers were multi-engine models, either bombers or transport types. Steve Ashby finished fourth, Jack Sheeks finished 10th and Dale Campbell finished 14th for the USA scale team.

While having a great static score can help to put you in the top 10, you must combine this with a good, practiced flight routine and avoid bad luck. In F4C, the static scores were close; only one contestant broke the 1,800 mark. Pavel Fencl, who flew his Knoller C II to a fifth-place finish, took the top static score with the completely scratch-built model of a WW I German observation bomber. Almost any of the first 10 placers could have won with their static scores, which ranged from 1,812.00 to 1,689.50. The '96 world champion, who finished second in 1994, was Max Merckenschlager from Germany, flying a 1917 Albatross DVa; Max flew his way to the first spot this year by using the same model.

On Saturday, after a week of static and flight competition, fellowship and fantastic food, the championships ended. After the final official flight, the field was opened to the jumbo scale models while the final standings for the teams and individuals were calculated.

AWARDS

As the officials announced individual first-, second- and third-place winners for each class, the winners' flags were again raised. Officials from the Périgueux Aero Club and the French Aeromodelers International presented all team members, officials and judges with gift baskets from the event's organizers. Food, medallions of the championships, posters and wine were all included in this gesture of friendship.

On Saturday night, the closing banquet began with a 10-course meal, and more gifts were handed out. We were weary but happy when we left at about 1 a.m. with the party still going on—a wonderful time, not to be forgotten.

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.* ✦

U.S. team in town parade with South Africans just ahead. South Africa will host the Championships in 1998.

Winners

F4C Precision Scale

Pos.	Pilot	Model	Country	Static Score	Total Score
1	Merckenschlager	Albatros DVa	GER	768.00	3343.64
2	Handlik	Caudron G-3	CZE	1793.60	3295.98
3	Lüthi	Nieuport 28	CH	1798.50	3277.56
4	Reeves M.	Sopwith 1½ Strutter	GBR	1769.00	3241.58
5	Fencl	Knoller CII	CZE	1812.00	3224.64
6	Reeves J.	Sopwith Pup	GBR	1750.50	3184.74
7	Santucci	Caproni Ca 100	ITALY	1750.50	3165.30
8	Torres	Beechcraft T-42	USA	1722.00	3119.61
9	Foster	Sopwith Pup	USA	1747.00	3108.88
10	Vodesil	Aero 10-01	CZE	1689.50	3077.84
11	Roberts	Sopwith Camel	SAF	1694.50	3074.20
12	Elofsson	DH 82 Tiger Moth	SWE	1660.50	3067.20
13	Landi	DH 82 Tiger Moth	ITALY	1738.50	3041.22
14	Le Grice	Sopwith Pup	SAF	1649.50	2996.26
15	Ando	Kawasaki Ki 100	JAP	1671.00	2990.88

F4CL Large Scale

1	Reeves M.	Sopwith 1½ Strutter	GBR	1752.00	3433.50
2	Hutson	DH 82 Tiger Moth	GBR	1771.50	3275.00
3	Inga	DH 82 Tiger Moth	ITALY	1717.00	3157.00
4	Levy	Sopwith Pup	FRA	1696.50	3127.00
5	Pallavidino	Piper tripacer	ITALY	1500.00	3106.00

F4B Control Line Scale

1	Kazirod	Avro Lancaster	POL	1831.50	3409.50
2	Kromin	Antonov AN-14	AUS	1696.50	3226.50
3	Kramarenko	Antonov AN-26	UKR	1632.50	3130.50
4	Ashby	Dornier Do 17	USA	1488.00	2992.00
5	Kusi	Miles M14	CZE	1372.50	2889.00

FAI F4C Team Ranking

Pos.	Country	Score
1	Czech Republic	9598.46
2	Great Britain	9402.91
3	Italy	9121.56
4	USA	8959.41
5	Switzerland	8869.97
6	South Africa	8813.72
7	Germany	8762.97
8	Netherlands	7772.66
9	Belgium	7738.43
10	France	7704.37
11	Japan	7493.19
12	Spain	7364.42
13	Sweden	7163.67
14	Australia	4818.13
15	Finland	2818.74
16	Poland	2745.69
17	Ukraine	2566.00
18	Israel	1690.50

Team manager John Guenther (left) and Kim Foster work on Kim's Sopwith Pup prior to a flight in F4C. Kim finished 9th just behind teammate Ramon Torres—friendly rivalry. Kim, Ramon and Wayne Frederick pushed one another, and that helped the total USA team score.

MODEL AIRPLANE NEWS

PRODUCT REVIEW

by TOM HUNT

Aveox F10LMR & F16LMR Motors

Geared brushless motors for sailplanes

IN RECENT YEARS, the hot ticket in F5B sailplane competitions has been an Aveox* motor combined with a Robbe 3.7:1 planetary gearbox. My interest in this combination lies with possible uses of a similar Aveox/Robbe combo for the AMA Class B electric sailplane event (no. 612). Aveox recently released two of its 1409 series motors with Robbe gearboxes attached to serve that purpose. They call them their F10LMR and the F16LMR motors.

While it's well-known that brushless motors are more efficient than brush motors, this alone is not why I'm interested in them. Brushless motors also have two other distinct advantages over brush motors: they can be run at very high rpm without damage (in excess of 40,000rpm), and they require almost no maintenance! This is important to the competitor for many reasons. Not having to replace brushes and/or true commutators saves time for more practice flying. Also, knowing that a motor will perform reliably takes a lot of uncertainty out of contest day.

The Aveox F16LMR and Aveox F5LV speed control.

There are, however, other considerations. Brushless speed controls are still a bit heavier than controllers for brush motors. Aveox controllers aren't available in battery eliminator circuit (BEC) versions; this forces the modeler to install at least a 110mAh pack for the receiver, and that slightly increases the model's weight.

The good news is that on the F10LMR on 10 or 12 cells and the F16LMR on 14 to 16 cells are far superior to any other comparable brush system I've tested in terms of weight and output. Class B models are generally larger and can easily absorb the extra weight of the brushless system. Actually, when using 12 to 16 cells, BEC should not be used, so the total weight of a brush versus brushless system will be comparable. For these reasons, this article deals with the use of either of these motors as a Class B motor/gearbox combination.

DIMENSIONS AND SPECIFICATIONS

The Aveox's F10LMR, F16LMR and controller dimensions can be found in the chart. The system's total weight as supplied is 15 ounces. The system doesn't come with connectors (for between the controller and the motor), and competitors may choose not to install them because they increase line-voltage losses slightly. The connecting power cables are 14-gauge wire, and they're long enough for just about any conceivable installation. It's recommended that you shorten all the wires as much as possible to minimize voltage drop that would rob you of power, especially at very high current levels. The rotating magnet deep inside the motor is wrapped with Kevlar strands to allow rpm in excess of 60,000 to be achieved without fear of the magnet flying off the shaft.

The Aveox F5LV controller can handle up to 16 cells and 60 to 80 amps for short periods. It's much smaller and lighter than previous Aveox controllers, however.

The Robbe* planetary gearbox is small and as light as it can be to absorb the power being delivered by 1409 motors. That it is planetary in configuration puts the prop shaft in line with the motor. This facilitates its installation in narrow sailplane fuselages. The motor is equipped with an 1/8-inch-diameter shaft (3.2mm), while the gearbox output shaft is 5mm in diameter. The Robbe gearbox used in this review came with a plastic gear case; however, Aveox now supplies these motors with a metal gear case for added durability. Many prop adapters will fit this shaft, and at least one is available through Aveox as an option. Collet types are preferred when the input power approaches 600 to 700 watts.

TESTING

The F10LMR was tested on 10 and 12 cells. The data are presented in the chart "Test Data Results." In the past, I've been criticized for not stating what the temperature and barometric pressure were during my tests, so I've included this here. Some "propeller heads" who do more arithmetic than flying seem to think these two numbers are important; I don't for one reason: I'm not interested in absolutes—only in differences; and because my

Tabulated motor/controller/gearbox

SPECIFICATIONS

MOTORS—Aveox F10LMR and F16LMR

Length: 2.170 in. (excluding shaft)

Diameter: 1.465 in.

Weight: 8.8 oz

Kv: 1,040rpm/volt (F10LMR), 540rpm/volt (F16LMR) (This is the rpm at the gearbox shaft.)

Useful rpm range: 10,000 to 60,000

Voltage range: 7 to 14 (F7LMR), 10 to 27 (F16LMR)

Shaft diameter: ⅛ in. (for use with Robbe gearbox)

List price: $309.95

CONTROLLER—Aveox F5LV

Voltage range: 7 to 16 cells

Max. short run amps: 60 to 80

Weight : 2.9 oz. (with Sermos connectors)

Size: 0.46x1.6x2.5 in.

List price: $199.95

GEARBOX—Robbe Planeta

Ratio: 3.7:1 (planetary type)

Length: 1.25 in. (excluding shaft)

Diameter: 1.25 in.

Shaft diameter: 5mm

Weight: 3.3 oz. (w/prop adapter)

Price of motor, gearbox and controller: $440

Hits
- High-quality parts
- High output power
- Low maintenance

Misses
- No strain relief on cable to receiver

tests are all done on the same day under the same conditions, comparing a variety of props at several voltages is a good way to weed out the undesirable combinations, regardless of temperature and pressure. I tested folding props that drew up to 60 amps from the battery. The data show that nearly 4¾ pounds of thrust can be generated from this powerplant for less than 60 amps. It's interesting to note that, at 10 and 12 cells, the MAP* (Model Airplane Products) 13x7.5 prop is far superior to the matching Aeronaut* prop in current draw and corresponding thrust.

Tests continued using the F16LMR and one of the largest folding props in my inventory—the MAP 14x7.5. I first tested the prop blades on the stock 42mm hub (this dimension reflects the distance between pivot centers on the hub). To entice the motor to draw even more current, I tried two other hubs. Even at 14 cells, the motor refused to draw more than 36 amps, but it produced a whopping 6 pounds, 2 ounces of thrust! If I had larger props, I'm sure thrust might eclipse 7 pounds at 50 to 60 amps on 14 cells. This would be a very impressive powerplant for a 100-ounce sailplane with a wing area of 1,000 to 1,200 square inches.

The author holds his Defiant, which is powered by an F10LMR, 10 cells and a MAP 14x7.5 prop.

FLIGHT TESTS

I flight-tested the F16LMR in my Aura 2 high-performance F5B sailplane (see the April '94 issue of *Model Airplane News*). It first flew on an early version of an Aveox 1412. At that time, I flew the model on direct drive using 16 cells and 11- to 12-inch props drawing in excess of 45 amps at full throttle. With the new Aveox/Robbe combo installed, 14 cells and a 14x7.5 MAP prop, and knowing from the chart that this combo draws only 36 amps and has a very similar weight (approximately 72 ounces), launches were even more spectacular. Back in 1994, climbs on direct drive were fast and shallow. Now, with the F16LMR, climbs were near vertical on one third less current draw! What a difference the gearbox and the larger props make. Although this didn't surprise me, it was nevertheless impressive.

At the '96 Electric Nats, I flew the F10LMR motor on 10, 1,000 SCR cells in my AMA no. 612 design—the Defiant

Aveox 1409 series brushless motor and the Robbe gearbox

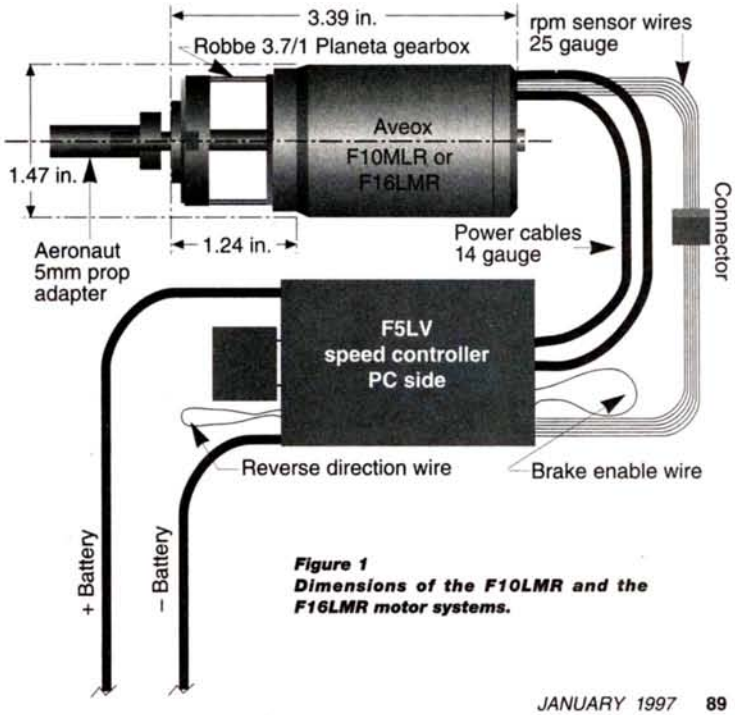


Figure 1
Dimensions of the F10LMR and the F16LMR motor systems.

TEST DATA RESULTS

F10LMR—10 to 12 cells

Prop	Amps	Rpm	Thrust	No. of cells	Voltage
13x7.5 MAP	49.5	8,500	4 lb., 5 oz.	10	9.4
12.5x6.5 Aero	50.2	8,000	3 lb., 15 oz.	10	9.0
13x7.5 Aero	58.0	7,100	4 lb., 6 oz.	10	8.4
13.5x7 MAP	55.0	7,000	4 lb., 5 oz.	10	8.3
13.5x7 ST	55.0	7,000	3 lb., 13 oz.	10	8.3
14x8.5 Aero	59.0	6,700	4 lb., 11 oz.	10	8.0
14x7.5 MAP	57.0	6,500	4 lb., 8 oz.	10	8.1
13x7.5 MAP	59.0	8,100	4 lb., 13 oz.	12	10.3
13x7.5 Aero	66.0	7,700	4 lb., 15 oz.	12	9.2

F16LMR—10 to 14 cells

Prop 14x7.5 MAP	Amps	Rpm	Thrust	No. of cells	Voltage
42mm	21	5,700	3 lb., 8 oz.	10	11.7
	28	6,500	4 lb., 8 oz.	12	13.4
	32	6,900	5 lb., 4 oz.	14	14.8
47mm	20.6	5,500	3 lb., 3 oz.	10	11.1
	26.5	6,200	4 lb., 4 oz.	12	12.8
	32.5	5,500	5 lb., 8 oz.	14	14.5
52mm	21.4	5,400	3 lb., 6 oz.	10	11.1
	27.4	6,200	4 lb., 9 oz.	12	12.8
	36	7,700	6 lb., 2 oz.	14	14.8

- The F16LMR was tested primarily on the MAP 14x7.5 prop. The mm designation is the distance between pivot centers on the prop hub, therefore, pitch and diameter are not quite as stated.
- Tests were run at 68°F and a barometer reading of 30.05 in.
- MAP = Model Airplane Products (France); Aero = Aeronaut; ST = Sonic Tronics*.

(plans are available from ModelAir Tech*), and I managed second place, only one point behind the first-place finisher. During the competition, the motor system performed flawlessly.

The Aveox F10LMR and F16LMR motors are excellent choices for Class B electric sailplanes. The combination of high-output power, low maintenance and compact size makes them suitable for models ranging from 800 to 1,200 square inches in wing area. This set-it-and-forget-it system saves us many headaches at the field. The F10LMR is a good choice on 10 or 12 cells and 12- and 13-inch props. The F16LMR will need 16 cells on a 14-inch prop, but you could drop back to 14 cells with larger props and those with a higher pitch than those I used (e.g., 15x12 Master Airscrew*, Aeronaut, or Robbe props). In the right model, to make it down in 8 minutes, either motor combination might need full spoilers deployed after motor shut-off! Maybe it's time to change the rules... hmmm....

If you have questions about this or any other electric project, email me at THunt95147@aol.com.

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.*

F-16S FLY OVER HOLLAND

Electric ducted fans are becoming popular, and though the ones we've seen so far were mostly very small, larger, faster, more powerful jets are now being flown. A group in the Netherlands has been using the high-rpm capabilities of Aveox 1409/2Y motors, 11 Sanyo 1700 SCRC cells and a Schwerdtfeger 8900E fan unit to fly the F16s shown here. This power system develops more than 2.5 pounds of static thrust from a fan spinning 22,000 to 23,000rpm.

The planes are a one-piece fiberglass design with a ready-to-fly weight of 64 ounces, and they're capable of speeds in excess of 110mph. Flight times at full throttle are 4.5 minutes, but they perform well at considerably lower throttle settings that lengthen flight times.

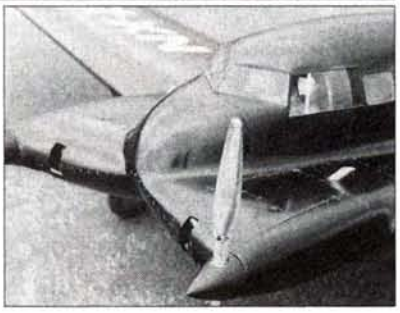
For more information, check out the Aveox website at http://www.aveox.com.

by BOB UNDERWOOD

TROUBLES WITH 3-VIEWS

HOW ABOUT A CHANGE of pace this month? So far, my bimonthly offering has presented building techniques (with the exception of my excursion into the wild world of widgets!). This time, let's talk of more esoteric things and pursue vague, capricious views—3-views, that is!

Whether you are a competition builder or a historical builder or you just build scale for the fun of it, the heart of your technique is the 3-view. This drawing—often more than three in "views"—becomes your plans when magnified and is your proof of scale in its original form. How accurate are those little gems? My opinion is that they rarely reflect reality. And that said, my tale begins!



PHOTOS BY BOB UNDERWOOD

The author's Alcor C.6.1 is an unusual twin-engine, six-passenger transport plane with a unique engine arrangement. After much study and research, Bob again found that available 3-views and color information were not accurate.

CLOWNING AROUND

During the 1970s, a modeling acquaintance extolled the virtues of the Wittman D-12 Bonzo. It's unusual, it's ugly, and it has character; nobody in his right mind would touch it for a subject. So-o-o, I had to do it! I searched for a 3-view and pictures. Although there weren't many pictures available, I located four different 3-views. What an interesting contrast they represented! One drawing by a very well-known aviation artist presented what was *almost* a sleek racer with curved cowl and canopy. Even my unpracticed eye pegged that one as inaccurate! What of the other three?

Logic suggested that the best thing to do was to hasten to Hales Corners, WI, and photograph the full-size aircraft at the former EAA museum. What a revelation that was. Not only did I discover that all four of the drawings contained errors—from few to "Wow!"—but a conversation with EAA employee Gene Chase increased my concern. Gene, now retired, restores vintage aircraft and has an eye for accuracy. He made a statement that startled! To his knowledge, no one had ever actually visited the Bonzo in the museum to photograph it *or* measure it! In short, it appears that the creators of those four drawings did so with the limited information available from vintage race photos and written information. During my research, which included more than three visits to Hales Corners, I had the added help of chance meetings with the Bonzo's designer, Steve Wittman, as well as the opportunity to talk to him when he was in St. Louis to address EAA members.

The author's model of the Wittman D-12 Bonzo racer. Because no accurate 3-views could be found, a trip to the EAA museum (then in Hayes Corners, WI) to verify its accuracy was required.

Bob Sonnenleitner, a modeler who helped with the restoration of the Bonzo, created a definitive set of drawings. With all due respect, I must caution a potential builder that the Bonzo in the Museum at Oshkosh has been "prettied up," and that belies the character of the 1930s race plane. It was given a stunning Imron paint job, and changes were made in the canopy, basic structure, etc. Although it was restored to the 1938 version, it has aileron counterbalances that weren't added to the aircraft until the 1939 race season. This brings up an interesting question: would a model of the museum aircraft be legal if it never flew in that configuration?

STORMOVIK SWEEP

Also during the early '70s, I built a model of the Ilyushin IL-2M3 Stormovik using the meager photos available and a Profile Publications 3-view. The model flew well, and six years later, it won the then-new Sport Scale class at the 1977 Nats in Riverside, CA. After about 10 years of competition, it was too oil-soaked to fly and was retired. I didn't build another until the '90s.

In the intervening years, I collected more photos, which I glanced at and deposited in the files. Then I acquired a fantastic set of drawings that had been prepared behind the Iron Curtain.

Every detail was there, including landing gear, rivets, etc.! Although all the detail contained on four sides of two large sheets was interesting, one discovery blew me away! Out came the old presentation. Out came the acquired photos. And what to my wondering eyes did appear but the inescapable proof that my earlier effort was wrong, *bigtime* wrong! The IL-2M3, or Tip 3, had outer wing panels with a pronounced sweep. That didn't show up in the Profile 3-view or the photos I had when I built the first model.

You can ponder whether that first model was wrong; certainly, you can state that it was not accurate according to reality. But it *was* accurate according to the presentation—an interesting issue to think about.

THE ALCOR MYSTERY

And the final tale. Again during the '70s, I came across a beautiful drawing of a very unusual aircraft, the Alcor C.6.1—a beautiful, sleek, twin-engine, six-passenger transport plane designed and built by Alan Lougheed in the late 1930s. It was all plywood, except around the nacelles, and featured rearward retracting gear that rotated à la P-40. The aircraft sat there on paper crying to be built!

I contacted Paul Matt, who had done the drawings. If you've been in scale very long, you are familiar with his carefully prepared drawings developed from exhaustive research. Paul responded with a handwritten letter to my inquiry as to whether other photos existed. He indicated that he rarely answered modelers because he received so much mail. But in this case, he was enamored with the aircraft. He also stated that to his knowledge, everyone associated with the project had passed away. He even sent me all the 4x5 negatives he had so that I'd be able to reproduce them. What a gentleman! Understand that the full-size aircraft crashed just months after its completion in 1937.

The model was built and flown, but it crashed because of a wrong CG location. It was rebuilt and flown at a Nats in Lake Charles, LA. I would love to say that it was a great success, but it wasn't! The homemade revisions to its Rhom-Air gear combined with the pointy Williams Bros. smooth-contour wheels made it a rolling nightmare; it never failed to stub its toes either on take-off or landing. In four rounds, I went through eight props! This model met its demise during a photo session for a magazine article.

The desire to build another remained. In 1977, I met Patty and Monty Groves—a couple who researched old aircraft and operated a company called Rare Birds. Patty wrote many articles, mostly for full-scale aircraft magazines. My experience with the Alcor piqued their interest, and they went looking for information. They found it in the form of Kendall Blackwell who, as a young man, had prepared the factory drawings for the Alcor. He still had a copy, and soon, I did as well.

Now I must digress for a moment. Paul Matt's drawing had indicated a modified Clark Y airfoil and that the aircraft was black with white registration. That's how my original model was built. Certainly, all the photos available to Matt suggested that this was correct.

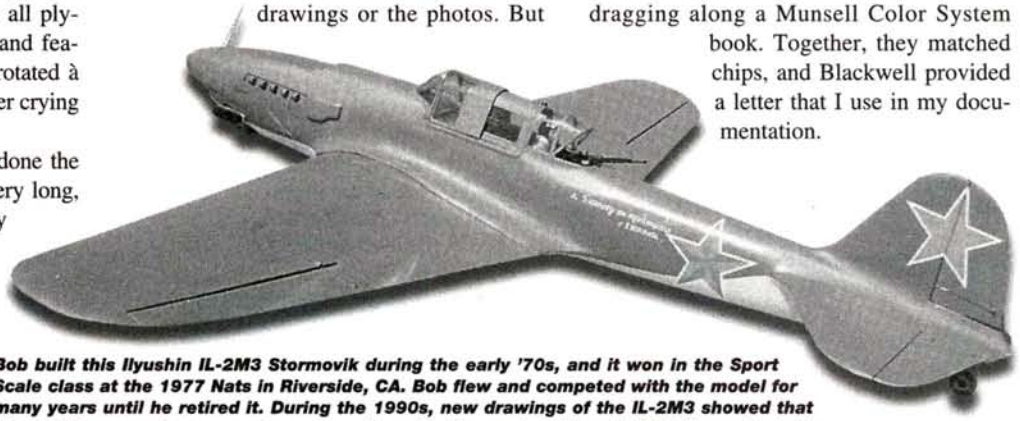
As I studied Blackwell's drawings, I realized that they were not practical to use for my 3-view. As is very often the case in the development of an airplane, the aircraft comes out quite different from the original drawing. In this case, window outlines, fillets and a host of items didn't match the Matt drawings or the photos. But tucked into the corner of Blackwell's drawing was a mountain of information, including the NACA numbers for the root and tip airfoils! I realized then that Matt had never known of this drawing or at least never had it to use!

On the evening that the Groves returned the original drawing to Blackwell, during a pause in their conversation, he casually asked whether photos would be of any value? Restraining himself from leaping out of the chair, Monty allowed as how they probably would. That's how I came to possess a dozen more photos of the Alcor that Matt didn't have.

Rejoicing in my good fortune, I studied the photos. Two, taken from a hangar roof looking down on the aircraft, seemed absolutely identical, except that in one, the aircraft had registration numbers; in the other, it didn't! Closer examination revealed that the photo without numbers had been airbrushed. Blackwell later said that Lockheed had hoped to sell the Alcor to the military and had that shot prepared.

Back to leafing through! Here's a good nose-on shot. Here's one of the cockpit mockup. Here's one of a man in shirt and tie standing in front of the vertical fin. Here's one ... wait a minute! Back to the man and fin! Look at the registration numbers, and look at the man's shirt. In 1937, the shirt would most likely be white, but the numbers have a tint of gray to them! Phone call to the Groves. Trip to Blackwell. What color *was* the Alcor? Blackwell indicated that they had used Berry Brothers paints and had gone for maximum contrast and durability; the Alcor was Intense Black with Loening (chrome) *Yellow* registration numbers.

With a Berry Brothers paint chart, the Groves visited Blackwell again, this time dragging along a Munsell Color System book. Together, they matched chips, and Blackwell provided a letter that I use in my documentation.



Bob built this Ilyushin IL-2M3 Stormovik during the early '70s, and it won in the Sport Scale class at the 1977 Nats in Riverside, CA. Bob flew and competed with the model for many years until he retired it. During the 1990s, new drawings of the IL-2M3 showed that his model was not as accurate as was thought. The model did not faithfully replicate the full-size plane, but it did match the available 3-views and documentation. Something to think about.

It's interesting to go back and study all the Matt photos. Because of the angles at which they were taken, the light reflections clearly suggest a black airplane with white registration. Again, if he had access to the photo Blackwell provided, I have no doubt that he would have questioned the situation.

I have waxed eloquent for too long now, so I must conclude. Somewhere in this dialogue, there must be a moral or two; I'll leave that to your reflection. Suffice it to say that when I can't view the actual aircraft (or even when I can!), I'm v-e-r-y careful about believing 3-views. This should help you understand how difficult it is to be a judge.

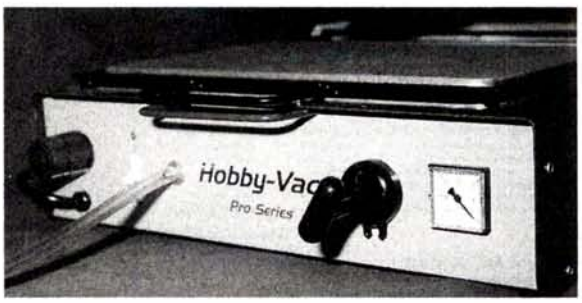
MODEL AIRPLANE NEWS

PRODUCT REVIEW

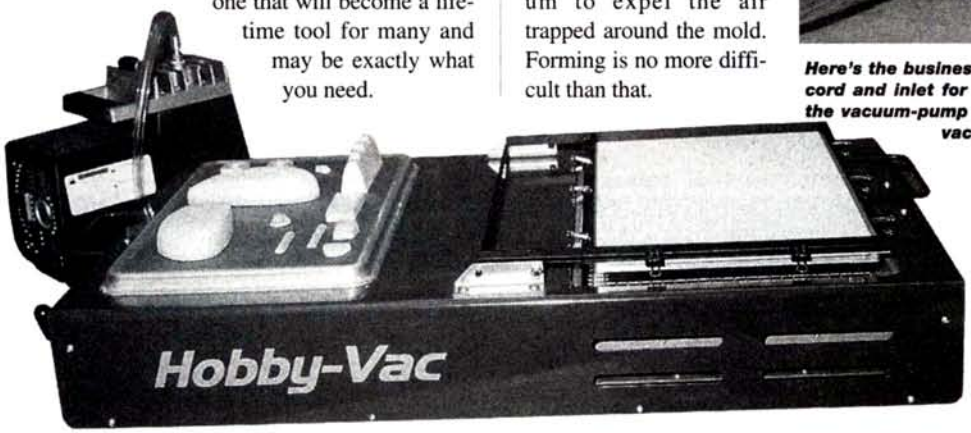
by JIM SANDQUIST

FOR A number of years, Doug Walsh, owner of Vacuum Form*, has produced low-cost vacuum-forming systems for the modeling community. His latest system is one that will become a lifetime tool for many and may be exactly what you need.

What exactly *is* vacuum-forming? Quite simply, it is heating a sheet of plastic to just under its melting point and then stretching it over an original mold. This stretching is done by using a vacuum to expel the air trapped around the mold. Forming is no more difficult than that.



Here's the business end of the Deluxe. Left to right: the power cord and inlet for your shop vacuum, the oven on/off switch, the vacuum-pump inlet, the long-stroke hand vacuum and the vacuum gauge.



Here's the complete system with some pieces that are ready to be formed! On the right, the plastic sheet is in place over the 110V oven. The 3/4hp vacuum pump that comes with the Deluxe version is behind the system.

VACUUM FORM'S

Hobby-Vac Pro Series

Canopies to cowls with professional results

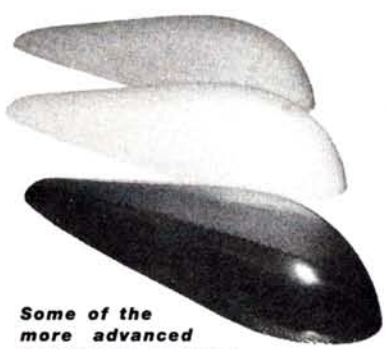
WHY VACUUM-FORMING?

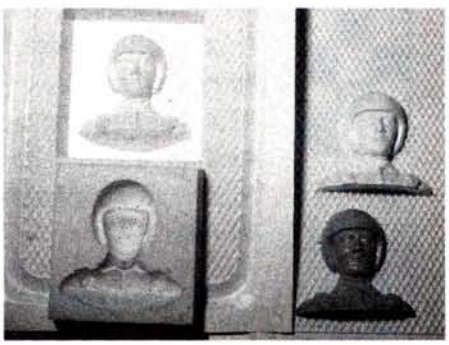
As a modeler, I often find it necessary to make my own parts. Until I started vacuum-forming them, it was quite time-consuming. If more than one of the same part were required, it became even more laborious. Vacuum-forming has simplified and streamlined this task for me.

Once you understand the basic concept, there are some advanced methods of vacuum-forming that you can try. Where can you learn some of these advanced techniques, such as forming from a female mold instead of a male mold? Included with the Vacuum Form kit is a very well-written, 130-page book that explains in great detail the basic theory of forming, the types of molds and how to make them, where to buy plastic sheet and tips for troubleshooting common forming problems. With the information in this book, you'll get professional results even if you have never done any vacuum-forming.

Common applications for vacuum-forming include canopies, inset windows, plastic fairings, wheel pants, cowls, air scoops and cockpit interiors such as side panels, floorboards, instrument panels and throttle quadrants. You are limited only by your imagination.

PHOTOS BY JIM SANDQUIST





Some of the more advanced techniques, such as male and female forming and tricks for pulling canopies over balsa without a lot of surface preparation, are explained in the included vacuum-forming book.

THE SYSTEM

The New Pro Series system features a 110V oven, a flip-over clamp frame, a built-in two-stage vacuum valve that will allow you to use your shop vacuum if you need to increase the "forming" speed, a sample plastic sheet, instructions and a 130-page book that thoroughly explains the vacuum-forming process.

The all-metal system is available in two models. The Deluxe comes with a front-mounted vacuum gauge and a 3/4hp electric vacuum pump, which eliminates the need to use any type of shop vacuum. The Standard is the same system, but without the gauge and electric vacuum pump. It uses a long-stroke, high-volume hand vacuum pump that's built into the front of the cabinet to supplement your shop vacuum. All the fittings are on the standard version, so you can upgrade your system anytime!

The unique flip-frame design ensures that your molds won't be overheated

SPECIFICATIONS

Construction: welded-steel clamp frame and aluminum housing

Weight: 50 lb.

Heat source: 110V infrared heat and convection oven

Forming platen: 12x18 in.

Dimensions: 21x38x7 in.

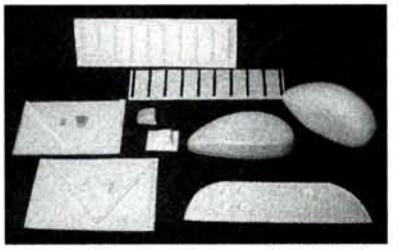
List prices: $599 (Deluxe), $458 (Standard)

Features: the Deluxe includes a 110V oven, a ¾hp vacuum pump, a hand pump, vacuum gauge instructions, a sample plastic sheet and a 130-page book about vacuum-forming. The Standard does not include the ¾hp vacuum pump and the vacuum gauge.

Comments: the system has optional sheet reducers that allow you to form smaller sheets of plastic. Prices: $54.95 (6x9 in.), $64.95 (9x12 in.).

Hits
- Easy to use.
- Heavy-duty construction throughout.
- 130-page vacuum-forming book included.

Misses
- None found.



Simple things such as cockpit interior walls, instrument panels, air scoops and wheel pants are easily vacuum-formed.

because the heat source won't be directly over them. This can be important for maintaining the clarity of clear canopies and windows.

Using either the hand pump or the electric vacuum pump will allow you to pull up to 28 inches mercury. For most applications, you will be satisfied to pull plastic that is less than 0.060-inch thick; but in fact, the system is capable of pulling plastic as thick as ¼ inch!

The large, 12x18-inch vacuum platen allows you to pull canopies and cowls for many aircraft. If you don't want to use a large sheet of plastic for one small part, the system also has optional reducer trays that will allow you to pull 6x9-inch and 9x12-inch sheets.

FINAL THOUGHTS

This high-quality system is well-built. It is heavy duty and will last for years, and it's capable of light-duty manufacturing as well. The two-year warranty and 30-day unconditional money-back guarantee should remove any doubt about the quality of the system!

If this 110V system is more than you need, Vacuum Form offers its high-quality line of small machines starting at $99. Any of these systems would be a great addition to your collection of modeling tools.

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.*

PHOTOS BY VIC OLIVETT & GENE BIGAOUETTE

WHEN I OPENED the box, the size of Cermark's F-20 Tiger Shark surprised me. This is a big airplane! My first thought was that a .60 engine would be too small, but my mind was at ease when I felt how light the components were. The kit is so complete that all you'll need is a good .60 engine with a pipe, a 5-channel radio and some Zap* glue.*

CERMARK

F-20 Tiger Shark

A sport ARF with Top Gun performance

by VIC OLIVETT

• **Airframe.** The custom-built, covered airframe is designed for strength and quick assembly, but as with all ARFs and prebuilts, it is a good idea to check the work. On the bottom of the fuse in front of the wing, I found two joints that were not glued properly. A little thin Zap corrected this problem.

The wing, fuse and tail feathers are all hinged and covered with Carl Goldberg* Ultracote. I ironed out some wrinkles that had formed during shipping and storage.

The supplied retracts are a standard, mechanical, three-gear system. They're easy to install, and they work well with standard servos. No special retract servos were needed.

• **Wing.** This has two servos: one for the main retracts and one for the ailerons. The servo for the retracts is recessed in the wing, and the mounting blocks are glued into place with medium Zap. This servo will lower and retract the landing gear, so be sure that the mounts are strong and that the servo arm is centered on the wing. The other wing servo is mounted on the precut plywood servo tray. For a good fit, the ailerons have been slotted for the hinges and torque rods, but some minor cutting may be necessary to center the hinges. There shouldn't be a gap.

The instructions show the shape of the retract-activation pushrod, which you can use as a pattern. I cut the retract struts to 4 inches. I found that the included axles caused the wheels to be off-center (which meant that they wouldn't retract properly), so I replaced them with lower profile Great Planes* axles (part no. GPNQ4281), and this corrected the problem. The instructions recommend that you use screws to hold the retract units in the wing, but knowing that grass fields are rough on landing gear, I replaced the screws with 4-40 bolts and blind nuts. When you're satisfied with the retract installation, test them for proper cycling. It's recommended that you use at least an 800mAh battery pack to compensate for the battery drain added by the retracts, but to be safe, I used a 1200mAh pack.

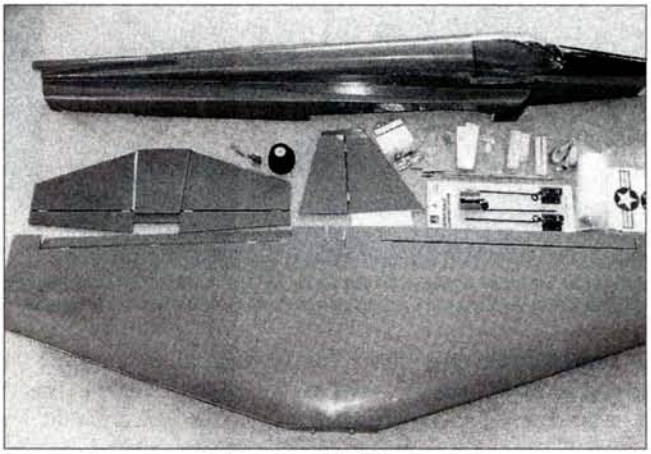
• **Fuselage.** The wing hold-down bolt holes were already drilled and the blind nuts are included. I secured the blind nuts with medium Zap and used two large, flat washers under the bolt heads to spread the load. A Thunder Tiger* Pro .61 with a Mac* pipe provides the power, and the engine fits like a glove. The instructions suggest that you install the engine with bolts and locknuts. You can hold the locknuts in place for tightening by cutting the covering on the opposite side of the engine and using a socket or nut driver, but I decided to use 6-32 bolts and blind nuts with some Loc-tite*, which eliminated having to cut the covering for access.

The included fuel tank extended past the second bulkhead, and that caused the rear of the tank to sit ½ inch higher than the front, so I used a Sullivan* 428 tank for a better fit.

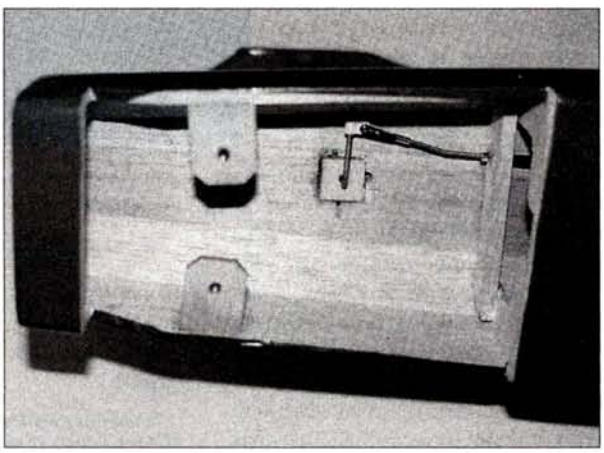
Trim out the nose-gear mount and bay area for a proper fit. As with the main gear, the nose-wheel axle caused the nose wheel to be off-center. I replaced this axle with one from Great Planes. The nose gear has two pushrods—one for steering and one to activate the retracts.

• **Tail feathers.** The Tiger Shark has a large rudder, and a good, tight fit is very important. At high speed, the rudder may tend to flutter if it isn't properly installed, and the long pushrod can add to the flutter. I felt as though some extra bracing wouldn't hurt.

The elevator servo is mounted directly on the stab for good, positive linkage, and the stab is then bolted to the fuselage.



The complete, covered kit comes out of the box in four major components. A few hours are all that's needed to assemble the F-20.



Here you see the horizontal stab mounting saddle, and inside the fuselage, you see the internal rudder-control linkage. It's a very clean design, with all tail connections placed in the fuselage.

SPECIFICATIONS

Manufacturer: Cermark Model Co.

Model: F-20 Tiger Shark

Type: sport-scale ARF

Wingspan: 56.5 in.

Length: 66.5 in.

Wing area: 756 sq. in.

Weight: 7.5 lb. (7 lb., 13 oz. as flown)

Engine req'd: .60 to .75 2-stroke

Engine used: Thunder Tiger Pro .61

No. of channels req'd: 5 (elevator, throttle, aileron, rudder and retract)

List price: $396 (ARF), $366 (ARC)

Features: a custom-built, covered airframe that's designed for strength and easy assembly. The kit includes instructions, retracts and all necessary hardware.

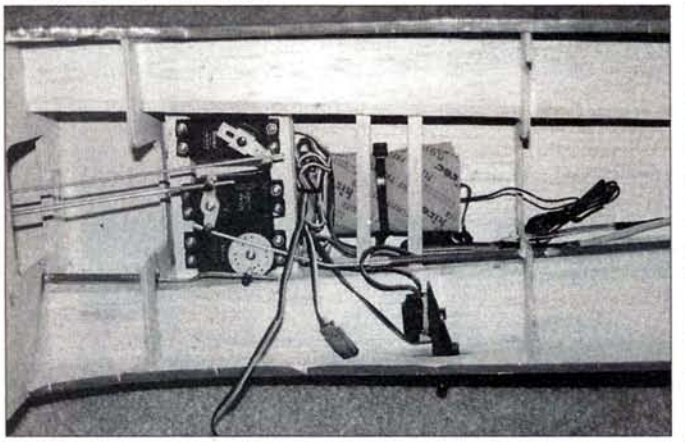
Comments: in slow flight and during landings, the Tiger Shark handles like a trainer, but it provides unlimited vertical performance at high throttle. This model is fast!

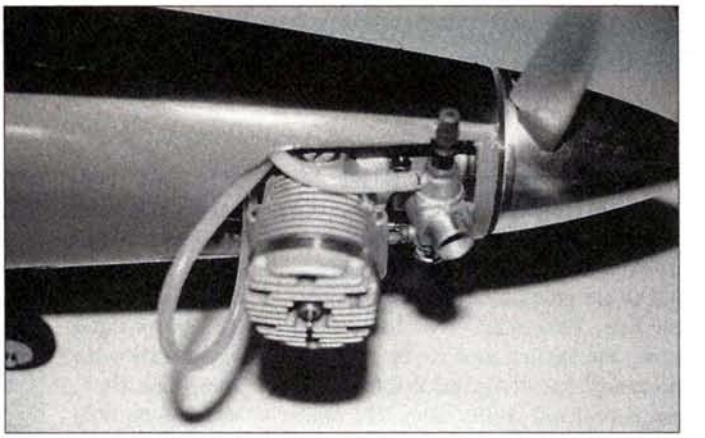
Hits

- Excellent kit design.
- Easy to build.
- A real blast to fly!

Misses

- After several flights, the vertical fin base became loose. It should be reinforced.
- The supplied axles cause the wheels to be off-center.
- The supplied fuel tank doesn't fit well in the fuselage.





Left: there's gobs of room in the F-20 fuselage for the radio. Move the battery around until you achieve the proper CG. Right: the nose is sleek and jet-like and the Thunder Tiger Pro .61 fits as if it were made for it. The spinner comes with the kit.

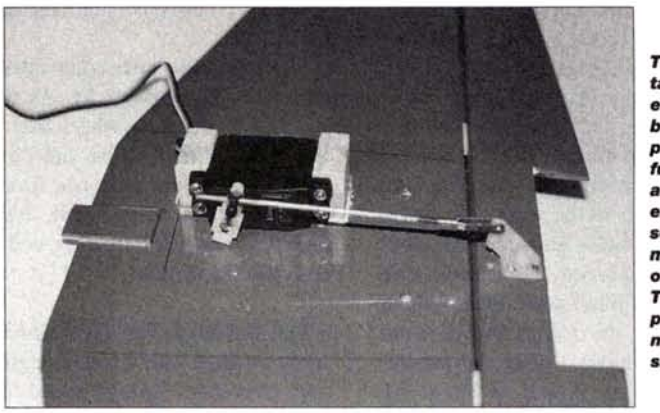
• **Radio installation and trim.** The instructions state that the battery should be installed in the extreme rear of the plane, but I found that this made the F-20 tail-heavy. Installing the battery just forward of the wing hold-down block was the best solution. This set the CG at 4½ inches back from the leading edge. I finished the rest of the radio installation following the instructions.

I used 21st Century* red, white and blue film for the finishing trim. Applied at a low temperature, this worked well over the Ultracote.

AT THE FIELD

With everything checked and rechecked, I was ready to go. On the ground, the Thunder Tiger Pro .61 and 11x7 prop turned 13,700rpm. The taxi to the end of the grass runway immediately showed that the steering was a problem. After a few attempts, it was back to the workshop. I found that the stock steering arm was too flexible for the grass field. I replaced the arm with one from a set of Spring-Air retracts and added some bracing to the steering pushrod.

Back to the field! Now the steering and nose wheel worked fine. Into the wind and with full throttle, with just a touch of right trim, the F-20 tracked straight down the runway and rotated like its big brother. I knew this one was a winner! At just a bit more than ½ throttle, this thing was in a groove. On the second pass, the gear came up perfectly.



The horizontal stab and elevator are bolted into place on the fuselage, and the elevator servo is mounted on the stab. The short pushrod minimizes slop.

FINAL THOUGHTS

If you're looking for something different and you're ready to play Top Gun, you'll love the Cermark F-20 Tiger Shark. What a rush!

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.*

FLIGHT PERFORMANCE

• Takeoff and landing

The Tiger Shark tracks straight down the runway, has a level takeoff and climbs out with authority. During landing, the F-20 slows down well on base and is very stable on final. The touchdown is slow and nose-high, and rollout is surprisingly short. Anyone who can land a trainer can land the Tiger Shark.

• Low-speed performance

Pulling the throttle back required no trim changes, and the controls were still crisp and positive. The plane flew so slowly that it was difficult to stall. It handles like a high-wing trainer.

• High-speed performance

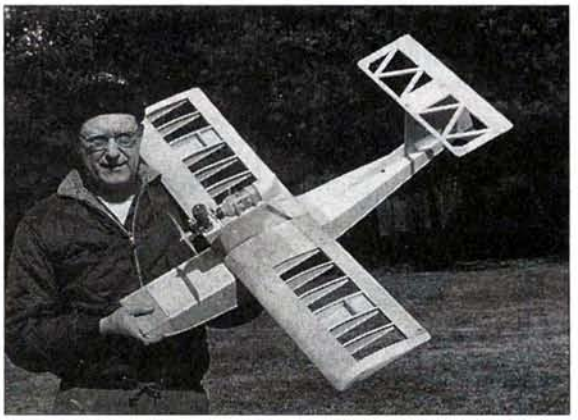
Now we're talking! When this model unloads, you'd better be ready, because it's fast! The vertical performance is unlimited. As a matter of fact, on the third flight, I put the model into a vertical climb-out right off the runway and was in the clouds only seconds later. After a few skipped heartbeats, I pulled the throttle back and waited for the Tiger Shark to reappear. I don't think I'll do that again anytime soon! After a few high-speed passes and five or six consecutive rolls, I knew the Tiger Shark was right at home. It tracked very well through loops, big loops, rolls and inverted flight.

• Aerobatics

For inverted flight, there's very little down elevator required and the model has no tendencies to snap out of maneuvers. As with any jet-like design, the Cermark F-20 likes the large, long, sweeping maneuvers so reminiscent of ducted-fan models.

by GEORGE WILSON JR.

BUILDING STRONG, LIGHTWEIGHT STRUCTURES



The author's Seasquare, built in the early 1960s, was very strong. Of the three built initially, one is still being flown by the author; the others may also still be in use. The wing uses LE and TE D-tube construction, and the tail surfaces are diagonally braced. This type of braced construction uses less wood than flat-sheet construction, but it's stronger because of the varying grain directions. The hull is balsa box construction. This model has survived many crashes.

A NICE FEATURE of scratch-building is that you can use your favorite construction methods. There is no perfect way. Perhaps you planned a lightweight model, or maybe an aerobatic type that needs strong wings. In any case, well-built structures and appropriate outer surfaces will provide the necessary strength without an undue increase in weight. It's inconceivable, however, to think that a structure can be built within allowable weight limits that will withstand the "ultimate" crash. Further, bear in mind that heavier models fly faster and crash harder.

FACTORS OF STRENGTH

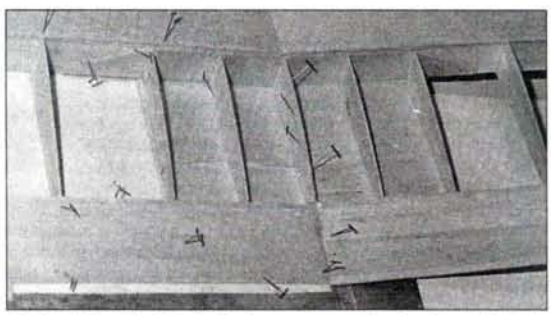
Factors that help determine a model's strength are the design of the structural members (spars and frameworks) and the use of outer surfaces ("stressed skin") to distribute and absorb stresses created in flight and on the ground, even in moderate crashes. Glues and glue joints also influence strength.

DESIGN TIPS

• **Strong wings.** There are many good techniques for building wings, and a detailed discussion of wing construction will have to wait for another column. I usually prefer to use plywood dihedral braces but many designers like the "stressed-skin" approach and use a fiberglass covering over the wing's center. In any case, in most R/C wings, the main spar should be a variation of an "I-beam" (see Figure 2). Of the variations shown, my favorite is "D," the full-depth spar type where the ribs are in two pieces. The parts of these ribs fit efficiently on the sheet wood so you'll have more ribs per sheet. The leading edge (LE) sheeting ("D-tube") section forms the upper and lower parts of the I-beam. Note that rib notches aren't required, and that simplifies building. This successful type of construction provides lengthwise strength with minimum weight. The I-beam spar and stressed skin with the D-tube LE are strong enough to survive when twisted. Incidentally, D-tube construction at the trailing edge (TE) as well as the LE provide additional bending and twisting strength. A wing with LE and TE D-tube is very rigid and relatively light. It will be even stronger if a strong covering is used over both the open areas and over the sheeted areas (more on this later).

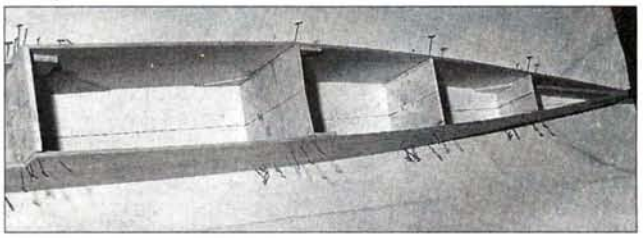
• **Strong fuselage.** A framework like the time-honored stick-fuselage construction can be figuratively developed: start with a solid block of wood and remove material (and weight) until it is like a section of diagonally braced fuselage.

Figure 1 shows the development of a stick fuselage from a block. If you are curious, build an unbraced section ("C" in the figure) and push on its corners. It will probably break easily. Brace it diagonally (F) and push the corners again; the difference is great because the brace distributes the reacting forces, as shown in "F."



Typical "double D-tube" wing construction is shown in this photo. Both the LE and TE have D-tube construction, and the spar and LE D-tube form an I-beam. Note that the spar is full depth; the ribs are in two pieces. The dihedral brace is a substantial piece of plywood. The center top sheeting was added later, and the center was covered with fiberglass and resin for added stressed-skin strength.

A typical balsa box fuselage before the top and bottom sheeting were added. Note that it is being built over a centerline with the bulkhead locations shown on it. To distribute the stresses along the fuselage sides, gussets are used at stress points. Lite-ply has become popular for building box fuselages. The author prefers balsa; it's lighter and easier to work with.

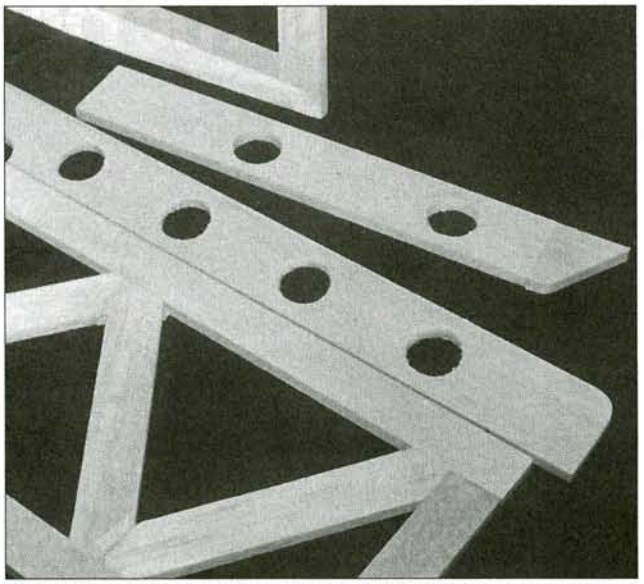


PHOTOS BY GEORGE WILSON

GLUE CHOICES

Part "H" of the figure shows a neat corner joint that should be well glued to ensure that it is strong and able to transfer forces. I prefer aliphatic-resin glue (Titebond, Sigbond*, etc.) and, anyway, I'm strongly allergic to cyanoacrylate. For strong joints, use aliphatic-resin glue and add small glue fillets to the corners of the joints.

CAs are rigid adhesives that can be brittle if they have been cured too quickly—typically, when an accelerant is used—or improperly formulated. Brittle joints are generally a result of improper glue use. Thin CA will readily be wicked into the wood's cracks and pores, especially balsa's. To guarantee that there is enough glue in the joint, you'll have to apply the glue more than once. If you've been modeling a while, I'm sure you'll remember the need to double-glue joints when you used Ambroid cellulose glue or when you used an older-style wood glue on end grain—different techniques for different glues. CA simply requires different techniques to be effective.



Typical diagonally braced tail surfaces. This type of construction is lighter than sheet surfaces and is stronger because of the varying grain directions. It is also more warp resistant. Note the neat fits at the corners: these ensure strength.

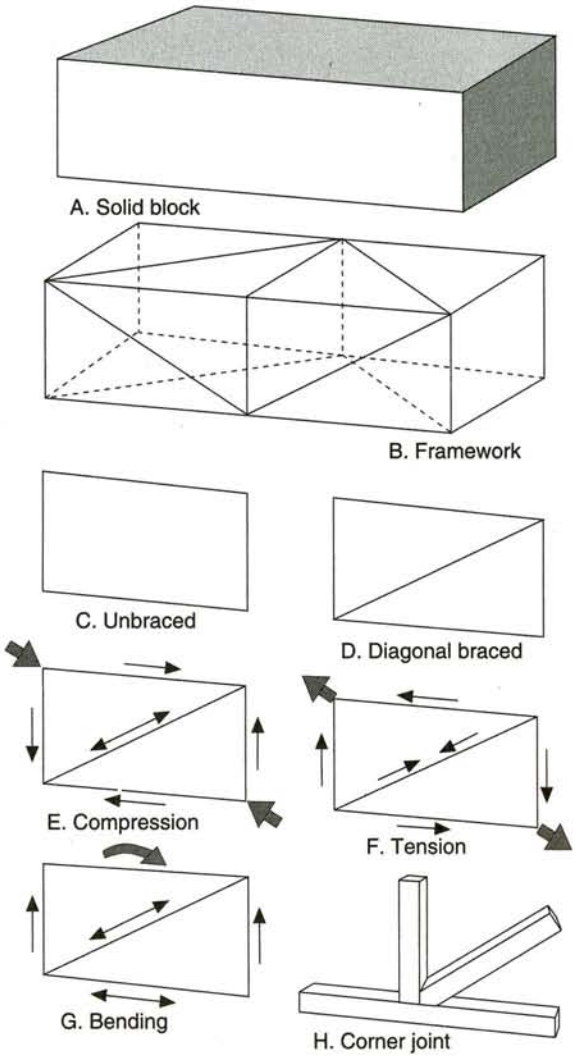
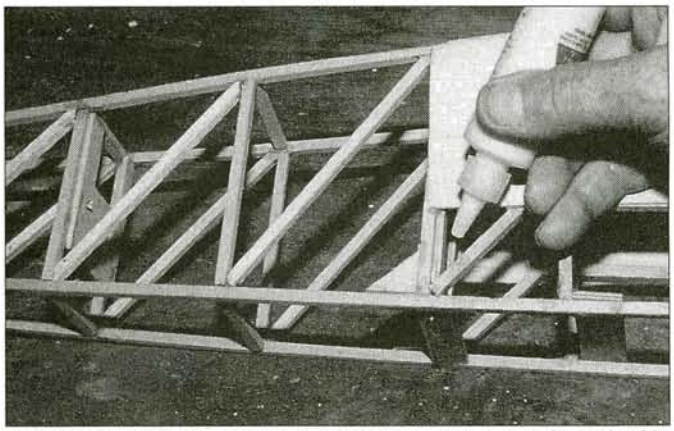


Figure 1. The figurative development of the diagonally braced framework (typically, a fuselage) is shown. The block is cut away until all that is left is the stick structure. The open framework (B) is surprisingly strong when compared with the block. The bracing accounts for much of the strength. An unbraced section (C) is very weak. The addition of a diagonal brace (D) makes the section quite strong. In parts "E" through "G" of this figure, the heavy arrows represent external forces, and the light arrows represent the reaction forces generated in the framework to counteract the external forces. In compression (E), the brace is in tension. In tension (F), the brace is in compression. In both cases, the brace strengthens the frame. In bending (G), the framework transfers the reaction forces to the sides and the diagonal. To ensure the best transfer of the forces within a frame, the corner joints must fit well (H) and be well-glued.

STRONG JOINTS

To ensure strength, many builders overuse glue, but neatly fitting joints are far more important. Sloppy joints bridged with glue do not provide strength, and they may increase weight. On the other hand, after a joint has been made, the use of small, neat fillets of glue around butt joints will add strength but minimal weight. The fillets act as "mini-gussets" and are similar to the full-scale gussets used in steel and wood construction.



Frameworks should be neatly fitted. Sloppy corners, as shown in this photo, may lead to failures and crashes. Aliphatic-resin glue (see text) is preferred. Apply a little around the joints to form gussets.

Hobby outlets offer a choice of miter boxes that will help you make good, repeatable joints. All these devices allow you to cut many sticks at exactly the same angle; some boxes feature adjustable angles. The ultimate tool for angling the ends of sticks is a sandpaper block. Cut the stick slightly longer than you need, then sand it to fit.

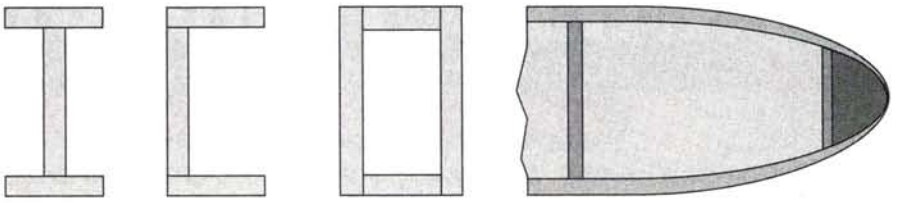


Figure 2. Cross sections of spars that work well are shown. "A" is the classic I-beam with its web centered between the top and bottom members. This type of beam is used in many full-size structures, such as bridges. "B" is common variation of the I-beam using an off-center web. Vertical-grain webbing is most often used, but this writer has used horizontal-grain webbing to increase the wing's lengthwise bending strength. "C" is a "box beam"—an I-beam variation with two webs. "D" is a variation that uses D-tube construction as part of the I-beam.

COVERINGS

The subject of covering materials that contribute structural strength is another long one that will have to come later. (For an in-depth review of the subject, see "Stressed-Skin Design" by Andy Lennon in the October 1992 issue of *Model Airplane News*). It is complicated by arguments about appearance, ease of use, sagging over time, brittleness and built-in adhesives. "Stressed skin" may be of covering materials such as plastic (Micafilm*, MonoKote*, etc.) or fabric (silk, Koverall*, etc.), or it may be wood such as balsa or plywood. For a convincing demonstration, build a wing framework but don't cover it; then flex it. Next add D-tube sheeting to the top and bottom LE, apply the overall covering and flex the wing again. The increase in stiffness will be dramatic.

My preference is for the less shiny types of covering because I find them more realistic. On the other hand, most aircraft seen at our flying fields (except scale models) are not truly realistic in design or appearance.

Carl Goldberg was fond of quoting from the 1939 book by French author Antoine de Saint-Exupéry, "Wind, Sand and Stars." Saint-Exupéry was a pilot and a philosopher who flew the early African routes. Carl's favorite part of Saint-Exupéry's book was his statement that "perfection is finally attained ... when there is nothing left to be taken away ...." Carl would add, "So it is with model airplanes." Incidentally, "Wind, Sand and Stars" is still available in my local library; it is well worth reading.

**Addresses are listed alphabetically in the Index of Manufacturers on page 137.*

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WANTED COX BOATS: Water Wizard, See Bee. Hydro-Blaster. Dean, 4032 Iowa St., San Diego, CA 92104. [12/96]

DEBOLT PLANS: radio control, control line, free flight. Separate SASE for each list. Fran Ptaszkiewicz, 23 Marlee Dr., Tonawanda, NY 14150. [3/97]

MODEL AIRPLANE NEWS, 1930-1980; "Air Trails," 1935-1952, "Young Men," 1952-1956; "American Modeler," 1957-1967; "American Aircraft Modeler," 1968-1975. $1 for list. George Reith, 3597 Arbutus Dr. N., Cobble Hill, B.C., Canada VOR 1L1. [3/97]

TOY METAL OUTBOARD BOAT MOTORS WANTED: Mercury, Johnson, Fuji, Oliver, Gale, Evinrude, Orkin, Sea-Fury, Scott. Gronowski, 140 N. Garfield Ave., Traverse City, MI 49686-2802; phone (616) 941-2111. [1/97]

A-J FIREBALL, flown, motorless, original box, attic stored. Anyone interested? Bob (610) 834-1932 (home); (215) 842-6955 (work). [1/97]

WANTED: Cox Curtiss Pusher kits, parts and motors. Dave Warrick, Box 42, West Point, CA 95255-0042; (209) 293-1249. [2/97]

SUPERTIGER G-4500: broken-in, never flown—$250. Randy (972) 529-1300. [3/97]

USED MOTORS: O.S. SR. 40, ringed, nice, used—$75. Supertiger 60, new style, near new—$130. **New motors:** Supertiger 3000, NIB—$210. **Small planes:** Sterling Lancer .60-size, flies great, no motor or radio—$175. RCM scratch-built forward swept wing with K&B 45, flies awesome, looks great—$175. EZ Super Decathalon with Magnum Pro 61, like new with Airtronics FM radio, unreal vertical & snaps, beautiful—$400. Hi-G Turbo Tube Twin with Magnum 46 SE's, Airtronics FM radio, flaps, flies very, very fast, lots of fun, new—$500. Dirty Birdi pattern plane with retracts, set up for O.S. 46, has tuned pipe, very pretty—$225. Holy Smoke Delta Wing with O.S. 46 BB tuned pipe, Airtronics FM radio, flies very fast, unreal—$325. Goldberg Ultimate with YS 120, with Airtronics FM w/smoke, ready to fly, very sharp—$775. M.A.N. Profile Hots with K&B .28—$125. Scratch-built Hots with Magnum .25 with Airtronics radio, very light—$265. RCM plans, built, Praying Mantis with Fox .40 BB with all servos, 75 inches long, flies unreal—$200. Jerry Juenemann, 383 Mopar Dr., Hays, KS 67601; (913) 628-6477 anytime. Can ship anywhere. [1/97]

BYRON HUSKY: potential wing strut failure. Free information. Write to Ron Smith, P.O. Box 926, Sequim, WA 98382. Please supply details about crash if Husky wing failed. [3/97]

RETIRED PILOT. Built my first model in 1938. Live across the road from world famous Anglers Paradise. Will build Gold Edition P-51D or float .60 Cub for cost + 2,000. Combine pick up with great winter vacation, fishing, etc. Plus flight test. Close to all attractions. Call me. Cliff Rozar, HC2, Box 108, Crescent City, FL 32112; (904) 467-2809. [1/97]

WANTED: old, unbuilt plastic model aircraft, Aurora, etc. Aircraft by old Japanese manufacturers. Dave Warrick, Box 42, West Point, CA 95255-0042; (209) 293-1249. [2/97]

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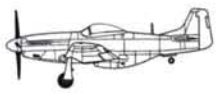
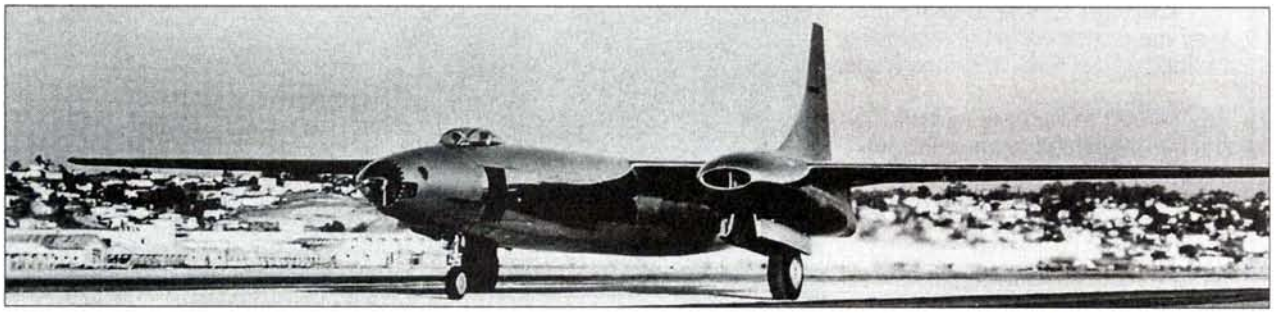
Zap Glue, FTE, 15300 Estancia Lane, West Palm Beach, FL 33414; (407) 795-6600; fax (407) 795-6677.



Name THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If you can, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 100 East Ridge, Ridgefield, CT 06877-4606.



Congratulations to Tom Solinski of Oklahoma City, OK, for correctly identifying the October '96 mystery plane as a two-seat Monocoupe 90AL. The Universal Moulded Products Corp. light cabin monoplane was powered by a Lycoming engine and had a maximum speed of 130mph and a service ceiling of 15,000 feet. The Monocoupe had a welded steel-tube structure with a wooden tail and wings that were covered with fabric. The 970-pound plane was 20 feet, 11 inches long, had a 32-foot wingspan and was 6 feet, 10 inches high. It could carry a payload of 286 pounds.

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to *Model Airplane News*. If already a subscriber, the winner will receive a free one-year extension of his subscription.

Product NEWS

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i4C PRODUCTS

Engine Compression Gauge

By testing engine compression, this versatile instrument can detect excessive piston wear, bent valves and leaking head gaskets in glow and gas engines. Each gauge comes with glow- and spark-plug adapters, extra valve cores, spare caps and O-ring and a rubber gauge guard.

Price—$39.95.

i4C Products, 6924 E. 92nd, Tulsa, OK 74133-5318; (918) 492-9435; fax (918) 492-9375.

TELSTAR

WipeOut Volume I

This exciting, 40-minute videotape includes nearly 80 spectacular crashes from some of the top U.S. and European events, including Top Gun and the Galveston Air Races.

Price—$19.99 (plus $3.25 S&H).

Telstar Video Productions Inc., 1501 SE Decker Ave. #108, Stuart, FL 34994; (800) 972-4847, fax (561) 220-4849.

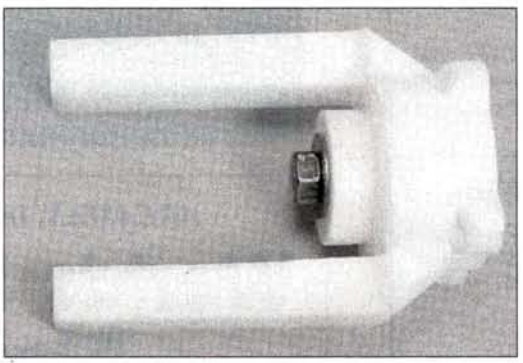
LTKM PRODUCTS INC.

Adjustable Engine Mount

This glass-filled nylon engine mount is easy to adjust: simply loosen the center nut, and you'll have a full 10 degrees of movement in any direction. The mounts are available for .45 to .61-size engines and weigh 3 ounces each.

Part nos. and prices—410400 (.45 size), $18.25; 410600 (.61 size), $18.75.

LTKM Products Inc., Ste. 412, 60-8 Bristol Rd. E., Mississauga, Ontario, Canada L4Z 3K8.



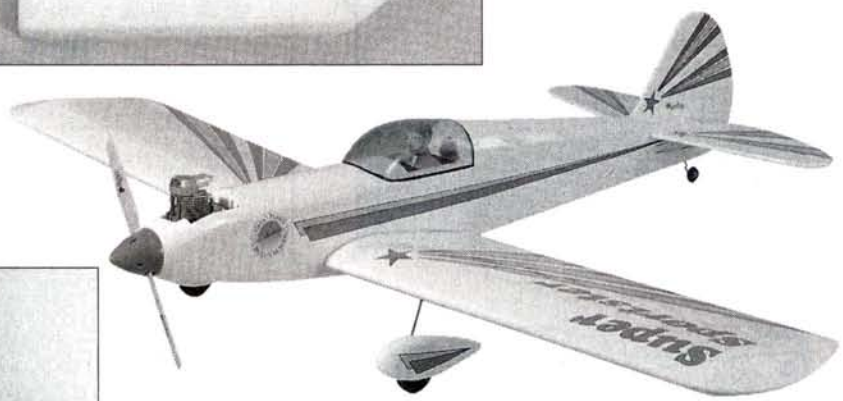
HANGAR 9

Aeropacks

These 4-cell, 4.8V receiver battery packs are made of quadruple-welded Sanyo cells with gold-plated pins and double-thick, double-shrink plastic to provide resistance to vibration.

Part nos. and prices—HAN7000 (270mAh flat), $15.95; HAN7010 (600mAh flat), $16.95; HAN7020 (600mAh square), $16.95; HAN7030 (1100mAh flat), $29.95; HAN7040 (1400mAh flat), $29.95; HAN7050 (1500mAh flat), $25.95.

Hangar 9; distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511.



GREAT PLANES MODEL DISTRIBUTORS

Signature Series Super Sportster 90/120

This special edition of the classic Super Sportster has new trim decals and a certificate of authenticity signed by Great Planes president Don Anderson. It features detailed plans, photo-illustrated instructions and interlocking wooden parts. Specifications: wingspan—72 inches; wing area—950 square inches; weight— 9.5 to 11 pounds; length—60 inches; engine required—.61 to .90 2-stroke or .91 to 1.20 4-stroke; radio required—4-channel.

Part no.—GPMA0215; **price**—$219.99.

Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826-9021.

ADVERTISER INDEX

INDOOR R/C BUGS

IF YOU READ this column in the July 1996 issue—Tom Atwood's introduction to "R/C Flying Bugs"—you know that awesome things are happening to create very small R/C flying machines. DARPA (Defense Advanced Research Projects Agency) is interested in shrinking the size of unmanned aerial vehicles (UAVs) to spans of less than 15 centimeters (less than 6 inches), and powerplants that will yield less than 1 ounce of thrust are under development. Imagine a turbojet or pulse jet this small! The electronics necessary to control these "bugs" are just around the corner.

Phil Smith demonstrates his "photon control" system.

The fallout is bound to find its way into the hands of the indoor flier; in fact, indoor R/C equipment is becoming available, and adventuresome modelers are taking advantage of this progress. Until a year or so ago, the problem was one of excessive weight, but that restriction seems to be evaporating. We know of at least one system, CETO, that makes indoor flight in reasonably confined areas a reality. John Worth, longtime executive director of the AMA, has taken it upon himself not only to furnish these lightweight systems but also to spearhead the development of lighter, stronger actuation devices for rudder control. His "Cloud Nine" newsletter is a mine of information for enthusiasts who are ready to do some pioneering. In a sense, we are back to where radio control was when rudder-only was a perfectly acceptable means of control. The famed Good brothers proved that much more than just turning right or left in the sky was possible with a single control, and for indoor use, rudder-only offers exciting possibilities.

John Worth's 1/4-scale (27-inch) version of Chet Lanzo's 9-foot, 1937 R/C Nats winner. Powered by a HiLine Micro-4 motor and three 110mAh cells, its total weight, with the CETO system, is 3 ounces.

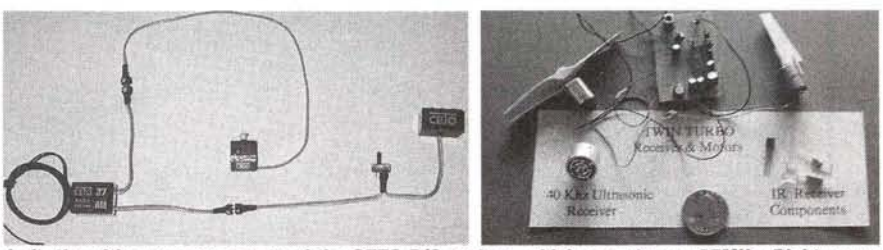
Another interesting R/C unit is the Twin Turbo R/C from the S.G. Corp.* of El Cajon, CA. The interesting thing about this system is that six functions can be selected from two control sticks. As delivered, two motors—tiny little fellows at about 4 grams each—can be commanded individually to turn in either clockwise or counterclockwise rotation. Neutral sticks call for no motor rotation, and that adds up to six commands. The receiver weighs a mere 7½ grams. One of the motors can be dedicated to thrust production with a prop and, with an extra battery and some circuit magic, can even be made to offer two speeds. The other motor can drive a rudder right and left.

The answer to indoor control may not be with R/C as we now know it. Phil Smith has managed to create a system using a flashlight as a transmitter and photo-diode/transistor amplifier as a receiver. Rudder control comes via a coil of wire and tiny, powerful magnets. Along these lines, the handheld remote we use for TV would seem to offer IR control possibilities.

The ghost of the genius Jim Walker of U-control fame may influence the use of ultrasonics for control. At one time, he had a large glider with a radio speaker installed in its side. He used a whistle, and the speaker (receiver) converted the transmission into an electrical signal for amplification. These were the days of vacuum tubes, so it was hardly a light and simple system. But it did work. Today, matched pairs of 40KHz ultrasonic transducers are available from electronic surplus suppliers such as the All Electronics Corp. of Los Angeles, and they are light, cheap and just waiting for modelers with imagination.

They were hardly the digital proportional jewels we use for R/C today, but these reversions to the so-called "bang-bang" or "galloping-ghost" systems of yesteryear can provide adequate control for indoor use. Range is not a problem, and batteries continue to get lighter and more powerful as time goes on. Very light digital-proportional systems are probably on the horizon, and the time is not far off when someone will show the gang how Delmar Benjamin, builder and flier of a full-size Gee Bee replica, does knife-edges and ribbon cutting—this time indoors, with a tiny, red-and-white "R/C flying bug."

—*Dick Johnson*



Left: the airborne components of the CETO R/C system, which operates on 27MHz. Right: some of the components available for experimentation with indoor R/C control.